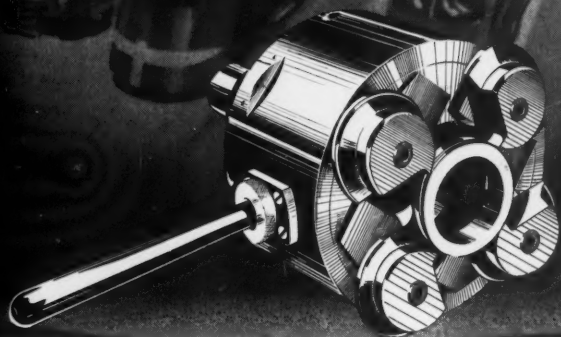


# MODERN Machine Shop

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TIME IS WHAT YOU HAVE TO WORK WITH



**Make this comparison** - With a single pointed tool you get one chip each pass. With a Namco multiple circular cutter head you get 4 chips each pass. You multiply your output 300 % and more. That's the minimum pay-in running time alone with Namco Hollow Milling heads.

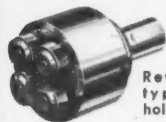
**Other advantages:** You sharpen a set of Namco circular cutters in the tool and check them for uniformity of grind. Then ONE simple adjustment in head brings all the cutters into final position. No fussing with individual adjustments for diameters, radii or shoulders. Ask for Namco Hollow Milling on your jobs. You are working with TIME, and time is money.

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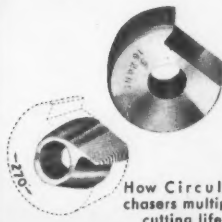
tools, because you hollow mill or thread with the same head—simply change cutters and blocks.



Non-revolving type with ground thread circular chasers.



Revolving type with hollow mills.



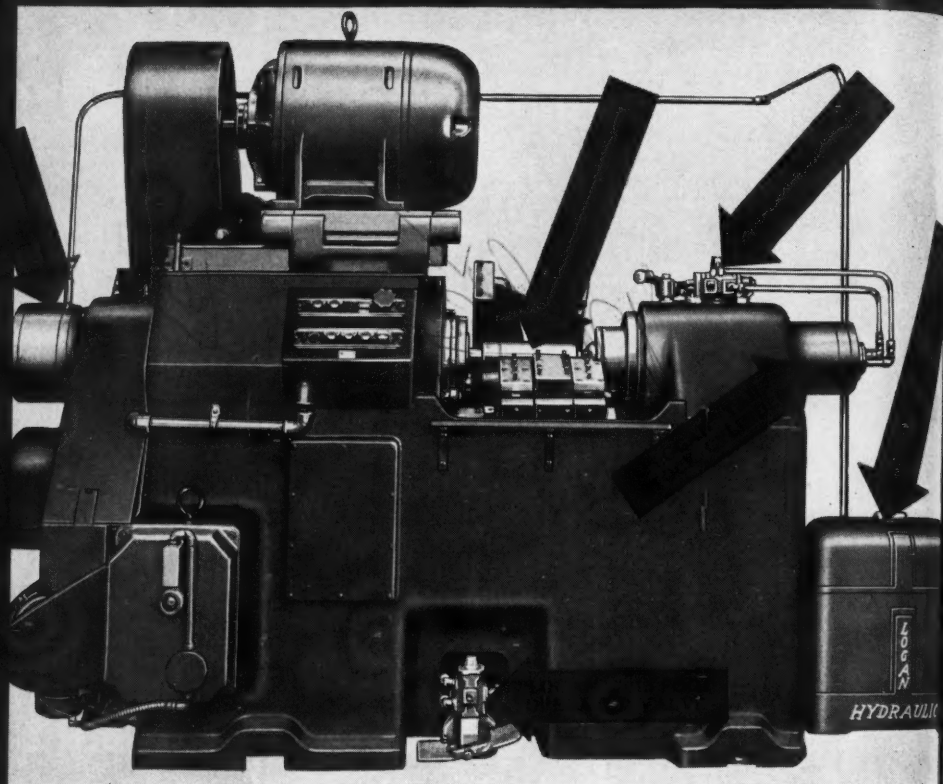
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The above illustrates an excellent example of hydraulic chucking as used for shell turning operations. The Expanding Mandrel and Tailstock are operated by Hydraulic Cylinders with adjustable pressures. Individual small Power Units for each machine, or a large Power Unit with Accumulator capacity for a multiple of machines, are available. Let "LOGAN" Representatives and "LOGAN" Engineers make recommendations on your shell turning problems.

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# MODERN Machine Shop

CINCINNATI, OHIO

JUNE, 1941

VOL. 14, No. 1

## We Present --

— as the feature article in this month's issue — a pictorial trip through a Diesel engine factory on the West Coast. Diesel engines have become very important as a source of power for marine use — and doubly important now that our defense program necessitates a considerable number of sub-chasers, submarines, and other fighting craft in which Diesel engines are used.

— on page 82 — the first half of a highly interesting and informative paper by J. T. Beard of the Socony-Vacuum Oil Company in which Mr. Beard discusses the effects of the various types of cutting oils on tools and the relation of the cutting oil to tool vibration, tool life, and surface finish.

— on page 106 — an illustrated article describing the method of building the big guns that are used for coast defense, on battleships, and for other heavy armament, and showing the special machine tools that are used for machining the hoops and rings and boring the barrels of these guns. This article should be of interest to everyone who has never been in a gun factory — and that means most of us.

— on page 122 — an appeal from the Production Division of the Office of Production Management for the cooperation of every American manufacturer on defense work. Included are instructions concerning the method to be followed in order to engage on sub-contract armament work.

— on page 134 — the third of Austen J. Smith's articles on the "Properties of Metals." We are glad to note that these articles are meeting with a welcome reception. Mr. Smith has done a very fine job of writing in that, while the material appears at first glance to be highly technical, in reality it is written so that anyone with executive qualifications who will read the articles carefully can understand them without difficulty. The material comprises the basis of the science upon which the study of metallurgy is founded.

The new department "Tools for National Defense" is receiving quite a bit of attention and will be maintained as long as special equipment is offered for manufacture of defense materials.

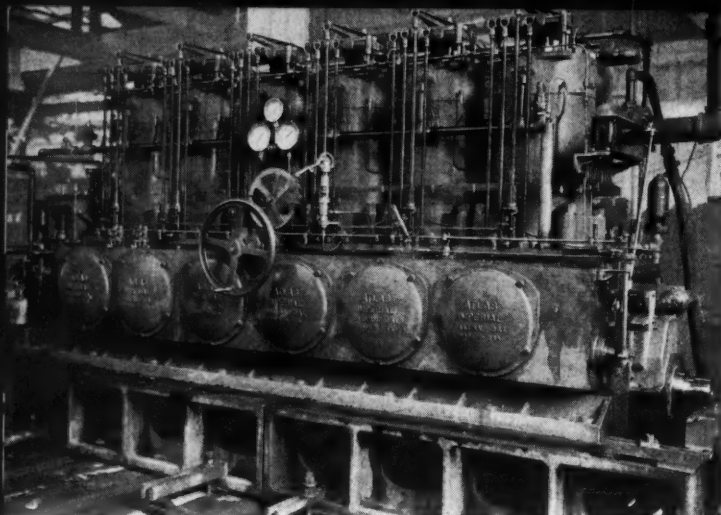


Fig. 1—Atlas Imperial 900 H.P. Diesel Engine Set Up on Testing Floor for Final Test

**T**HE conversion of fuel to power is a process the evolution of which began with the development of the steam engine. For stationary purposes under certain conditions the steam engine still has its place, but for mobile power, the conversion of fuel to power by the more direct method employed in the internal combustion engine provides an advantage.

At the present time, considering the ultimate goal as mechanical simplicity, minimum weight, minimum space requirements, and minimum

## Diesel Engine

By HOWARD CAMPBELL  
Editor, MODERN MACHINE SHOP

from 6 to 10 per cent of the fuel to energy; the best modern turbines convert from 20 to 30 per cent, and the Diesel engine is said to convert 35 to 40 per cent. The comparatively high efficiency of the Diesel engine makes it especially adaptable for marine use within a given range, and Diesels are employed extensively for the so-called "mosquito" torpedo boats,



Fig. 2—Turning the Crankpins and Journals on a Crankshaft for a 900 H.P. Atlas Imperial Diesel Engine

Fig. 3—Journal pins on engine

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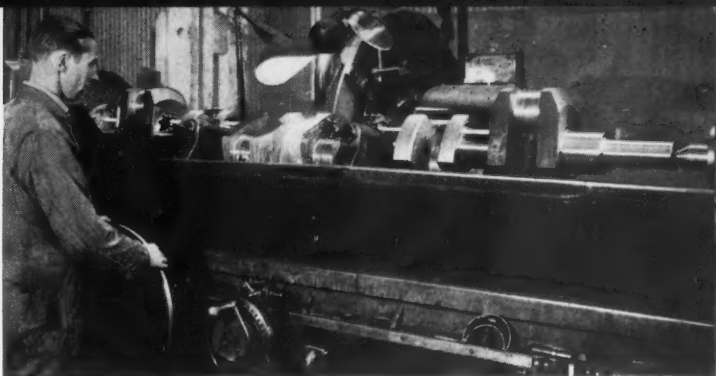
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Fig. 4—liners and reamed zonal bo Approx in. of st the bor moved

Imperial  
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Fig. 3—Grinding the Journals and Crankpins on a Diesel Engine Crankshaft



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sub-chasers, and particularly sub-marines.

Among the better-known builders of Diesel engines of this type is the Atlas Imperial Diesel Engine Company, of Oakland, California.

An Atlas Imperial 900 h.p. Diesel

volves the employment of machine tools and other metal manufacturing equipment which must both be large enough to serve the purpose and be thoroughly reliable as to accuracy. In the Atlas Imperial plant the heavier machine tools are aligned in bays which are served by traveling electric cranes. The size of the parts employed in the construction of an Atlas Imperial engine can be gaged from Fig. 2 where the operation of turning the crankpins on a Diesel engine crankshaft is shown in process. The shaft, which is being machined from a steel forging, is for a six-cylinder  $6\frac{1}{2} \times 8\frac{1}{4}$ -in. engine. The shaft is  $17\frac{1}{2}$  in. long overall. The bearings are turned to leave enough rough stock so that in the grinding operation the bearings can be ground to finish diameters of 7.499—7.500 in. and the crankpins can be ground to finish diameters of 7.499—7.500 in. The crankpin "cheeks" are faced to

## Linear Defense

*Defense means sub-chasers—and sub-chasing means Diesel engine power. Atlas Imperial Diesel Engine Company is doing its share for defense.*

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engine set up for testing is shown in Fig. 1.

The production of Diesel engines for marine service necessarily in-

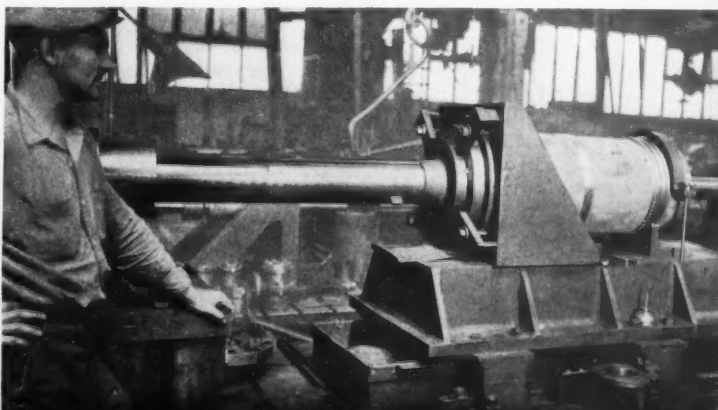


Fig. 4—Diesel engine liners are bored and reamed in this horizontal boring machine. Approximately 0.014 in. of stock is left in the bore to be removed by grinding.

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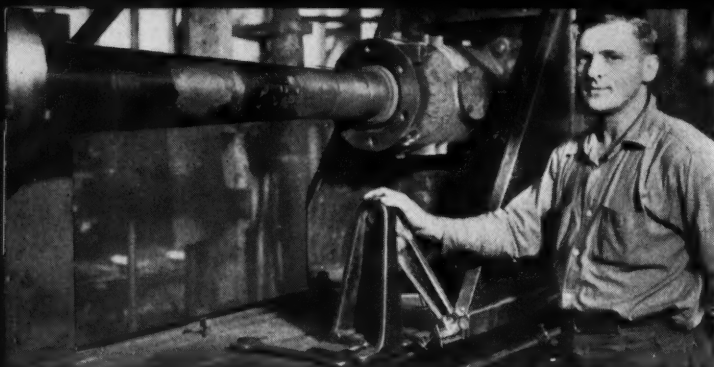


Fig. 5—This illustration shows a Cincinnati grinder set up to grind the bores in Diesel engine cylinder liners. The bore is ground 0.003 in. oversize and will be just exactly right after it has cooled.

provide a gap of 6.599—6.601 in.

As shown in the illustration, the end bearings of the shaft, which are turned in a preliminary operation, are clamped in heads which are aligned with the directional throws of the shaft so that the shaft can be shifted to any one of three sets of centers in order to bring each set of two throws in line for turning the crankpins.

The operation shown in Fig. 3 is that of grinding the main bearings and crankpins on a crankshaft for a 7 x 10½-in. Diesel engine. This shaft is 9 ft. 8 in. in length overall.

In the first operation on this shaft the bearings and crankpins were rough turned to 6½-in. diameter then, in the second operation, were semi-finished to 5½-in. diameter. In the

grinding operation, which is performed on the Cincinnati cylindrical grinder shown in the illustration, the bearings and crankpins are ground to diameters of 5.749—5.750 in. The finish dimension between the faces or cheeks is 5.999—6.001 in. The huge size of the grinder makes it practically impossible for the operator to see the contact of the wheel with the work; thus in order that he may see exactly what is taking place, a mirror is attached to the side of the wheel guard and set in an angular position so that the operator can see the reflection of the work and wheel at point of contact.

In designing a Diesel engine of the size built by Atlas Imperial, not only the efficiency of the engine but also problems involved in servicing such

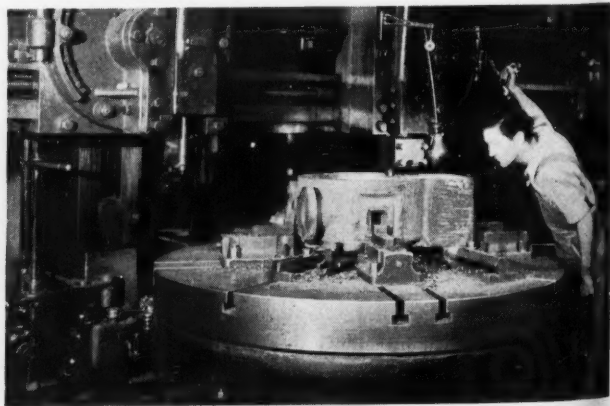


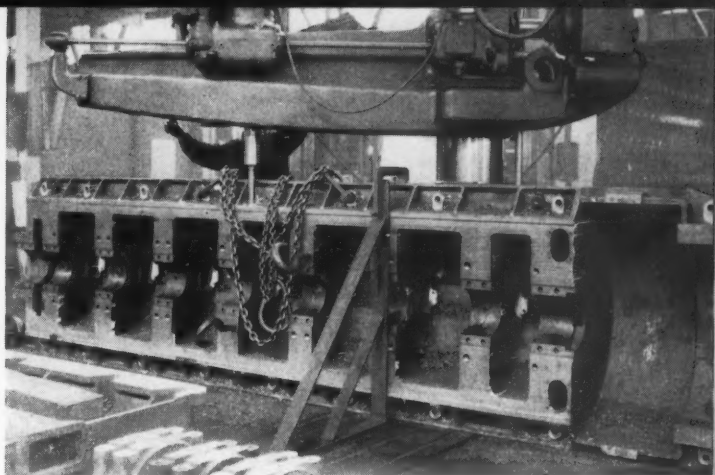
Fig. 6 — Machining Diesel Engine Cylinder Heads on a Cincinnati Boring Mill

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Fig. 7 — Using an Open-Side Planer to Machine the Various Fits on the Base for a Six-Cylinder Marine Diesel Engine



an engine must be taken into consideration. In the case of a scored cylinder, for instance, dismantling the engine and moving it into a plant in order to recondition a cylinder bore would entail a considerable amount of work and expense, in addition to which much valuable time might be lost in transporting the engine back and forth to the plant. To obviate this condition, liners are used in all cylinder bores so that in case of a damaged liner, the liner can more or less easily be pulled out of the cylinders and quickly reconditioned or replaced with a new one, necessitating the loss of but a few hours of time and involving a comparatively small amount of labor.

The liners must, however, be machined accurately, consequently the

bore in each liner is bored and then ground to size. The boring operation on the cylinder liners is performed in the horizontal boring machine shown in operation in Fig. 4. The machine is a "Barnett," made by Meadville Vise Company, Meadville, Pennsylvania.

The liner shown in process, which is to be used in a 600 h.p. engine, is 39 1/4 in. long. In the first or roughing operation a four-blade roughing cutter is used. In the second operation, which is shown in process, a six-blade cutter is used. This operation leaves approximately 0.010 in. of stock to be removed in the final boring operation. In the third operation

a n eight - blade reamer is used which finishes the bore to 12.986 in.,

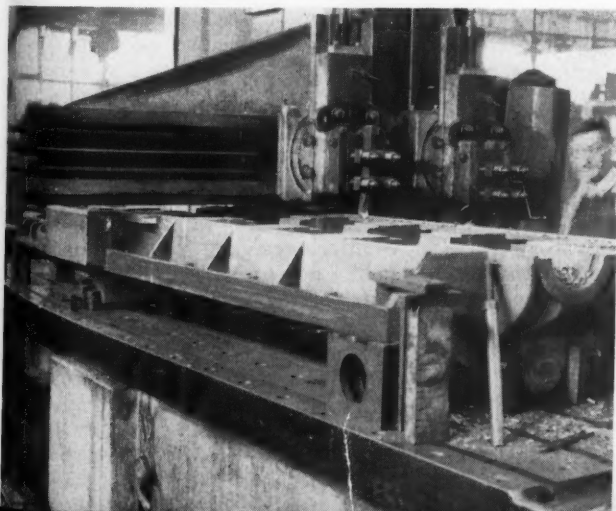


Fig. 8—With this Cincinnati Bickford radial drilling machine the base stud holes, bearing cap stud holes, and oil holes are drilled, tapped, or reamed as the case may be



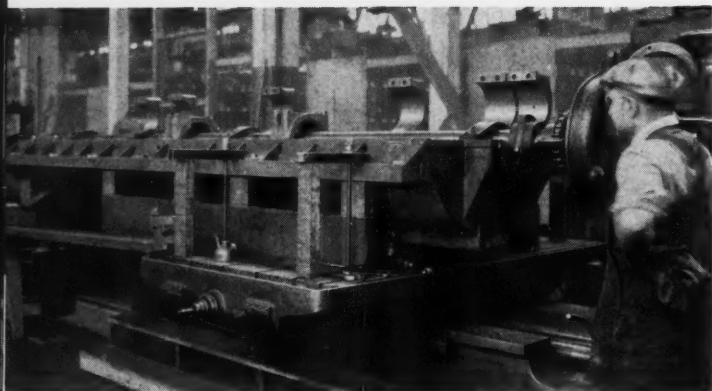


Fig. 9—Boring, Facing and Counterboring the Bearing Fits in a Marine Engine Crankcase

for a six-cylinder marine Diesel engine. The base is of cast iron and the machine is a Cleveland planer.

leaving 0.014 in. of stock to be removed in the grinding operation.

The bores in cylinder liners are ground to finish size in the Micro grinder shown in operation in Fig. 5. The illustration shows a  $7\frac{1}{2}$ -in. liner which is to be used in a six-cylinder 120 h.p. engine in process of finishing. When finished and cool, the bore will be 7.500—7.501-in. diameter. In this operation the bore is actually ground 0.003 in. oversize which has been found by experimentation to be exactly enough so that when the liner cools off after grinding it will be within the required limits.

Cylinder heads are machined on the Cincinnati boring mill shown in operation in Fig. 6. The head shown, which is to be used on a six-cylinder engine, is faced to  $11\frac{1}{2}$ -in. thickness, then bored to 13.062—13.067 in. and counterbored 14.765—14.770 in. The liner fit diameter is turned to 15.985—15.990 in. and a hole is bored through the center to 2.374—2.375 in. for the fuel valve. The depth of the combustion chamber is machined to an accuracy of within 0.010 in. so that the power impulses in all cylinders will be the same.

In Fig. 7 is shown the operation of planing the various fits on the base

Considering the variety in the types and sizes of engines required of this firm, it is more economical to plane these bases than to attempt the use of a planer-type milling machine.

One of the busiest machines in the shop is the Cincinnati Bickford radial drilling machine shown in operation in Fig. 8, facing an oil line hole in a base for a 400 h.p. marine engine. With this machine base stud holes are drilled and faced, bearing cap stud holes are drilled and tapped, oil holes are drilled in the bearings, oil line holes are drilled in the sides of the base, and a wide variety of other drilling, facing and tapping jobs are performed all of which necessitate the use of a machine which is versatile, dependable, and accurate.

After the crankcase for a marine engine has been planed and drilled and the bearing caps have been assembled to the case, the case is set up on the Giddings & Lewis horizontal boring mill shown in Fig. 9 where the end of the crankshaft bearing is counterbored and other boring and facing operations are performed. The crankcase shown in this illustration is to be used in the construction of a 280 h.p. (13 x 16 in.) six-cylinder engine. The case is 17 ft.  $2\frac{1}{2}$  in. overall

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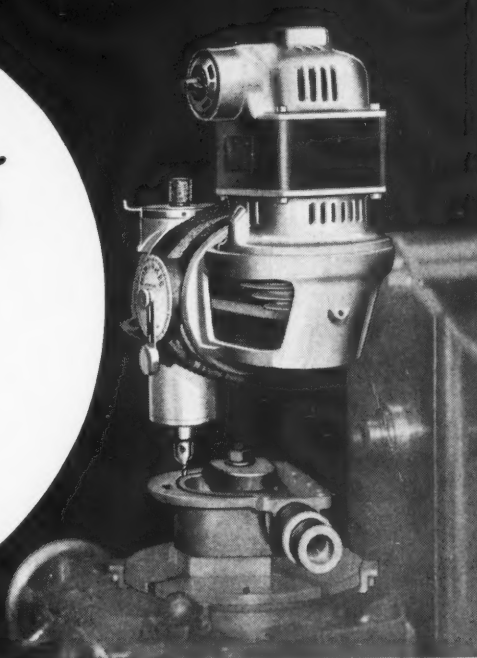
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# MILL-DRILL-BORE AT HIGH SPEED AND WITH POSITIVE ACCURACY



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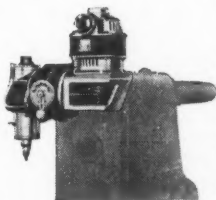


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### The "THOU- METER"



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— for accurate end mill speeds up to 5300 rpm. Easy to operate, furnishes closer sizes and improved finishes — adaptable to all types of milling machines.

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length and the finished diameter of the bearing bores is 10.000—10.001 in. There are nine bearings on this crankcase. When ready for assembling, bearing inserts which consist of steel shells with high speed Babbitt bearings are anchored in place. Force feed lubrication is used on all Atlas Imperial engines.

When all parts have been completed and the engine has finally been assembled together, it is moved to the test floor and put through its paces. Among the tests applied is the brake-horsepower test, for which the engine is hooked up to a water brake as shown in Fig. 10. With the engine running, enough water pressure is applied, by means of this brake, to test a 400 h.p. engine at 500 h.p. overload. If there are any faults in the materials or construction of the engine, they are sure to be discovered through the application of this test. The engine is operated at all the speeds which may be required of it in actual service, horsepower curves are plotted, and a report is made which covers the inspection of every detail of the engine. If the inspection report shows that the engine is

perfect, it is ready for shipment.

### Poster for Tool Crib

Distributed in the interests of careful handling of tools is the 11 x 17-in. cardboard poster illustrated herewith and issued by Koebel Diamond Tool Co., 9350 Grinnell Ave., Detroit, Mich. It carries no advertising. Beneath the color drawing of a workman is the caption: "When any man adds a single hour to the production life of a tool, or makes that tool do better work, that man makes a worthwhile contribution to American ideals and to America's future." Copy free to any plant executive upon request.



"Meehanite in Industry." The Meehanite Research Institute of America, Inc., 311 Ross St., Pittsburgh, Pa., has compiled a collection of articles about Meehanite castings into a booklet entitled "Meehanite in Industry." The booklet contains 49 pages and a number of articles covering descriptions of applications of Meehanite castings in a wide variety of industries. A table of contents page permits easy finding of an article on any subject of specific interest. Copy free upon request.

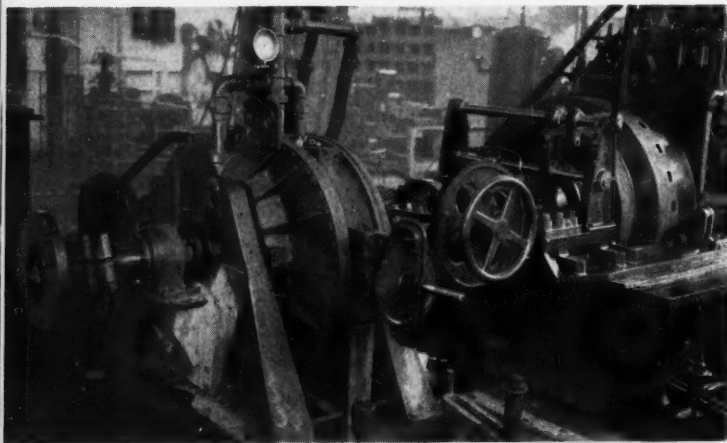


Fig. 10—Water Brake with which the Brake Horsepower on each Diesel Engine is Tested upon Completion. With this brake enough pressure can be applied to test a 400 h.p. engine at 500 h.p. overload.

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# How Effective Is Your Cutting Oil?

*A discussion of the effects of various types of cutting oils on "built-up edge," tool vibration, tool life, and surface finish*

*James T. Beard*  
\*By J. T. BEARD

Socony-Vacuum Oil Company, Incorporated

**I**N a brief discussion of this kind, it is not possible to cover the entire range of metals, machining operations, or cutting oils and coolants. For this reason I will limit this paper to threading, since this is probably the most difficult of all general machining operations, and to the relative performance of so-called non-soluble oils.

I will also try to confine my remarks to three distinctly different kinds of jobs: first, the threading of heat treated SAE 3140 bar stock (279 Brinell), a hard, fairly clean-cutting, medium - carbon, nickel - chromium steel; second, the threading of hot rolled SAE 1020 bar stock (122 Brinell), a relatively soft, draggy, low carbon steel; and third, the threading of 2-inch seamless steel tubing of approximately the same composition and hardness as SAE 1020. I will try to deal as little as possible with

theory, and as much as possible with the practical results of test work conducted under controlled conditions yet comparable with field practice.

The equipment used in these tests comprised a Warner & Swasey SA Turret Lathe with a 21½-in. swing and 4½ x 44-in. bar capacity, equipped with a 4-in. Landmatic die head mounted on the hexagon turret of the lathe. Standard Landis chasers of the 18-4-1 type were employed, hardened to Rockwell 62-63C. An Allis-Chalmers Vari-Pitch Speed Transmission made possible extremely small changes in surface speed, and an Esterline-Angus Graphic Wattmeter reported the power input. A Landis Model "Y" Chaser Grinder and suitable jigs assured accurate grinding of the chasers to proper cutting angles. Surface cutting speed was measured by means of a Zernikow Cutmeter. The flow of coolant was controlled at 2.5 gallons per minute. In every test, several check runs were made.

Inasmuch as field experience has always indicated that corrosive cutting

\* Presented before the Machinability Group, Cincinnati Chapter, American Society for Metals, and reported exclusively for MODERN MACHINE SHOP.



oils were more effective—especially in the threading of draggy metals—than non-corrosive oils, one of the first steps was to determine how much more effective these corrosive products are. Tests were run, therefore, on threading SAE 3140 bar stock (279 Brinell), first with a corrosive oil, and then with a non-corrosive oil. The results as given in Table I show that tool life, finish, and chaser wear with a corrosive oil were much superior to the tool life, finish, and chaser wear with a non-corrosive oil of the same viscosity and having the same percentage of base.

In the course of these tests, in order to determine what effect the viscosity of an oil might have, three different viscosities were employed; namely, 129 seconds, 169 seconds, and 205 seconds. The results, given in Table II, show that the oil of 169 seconds viscosity produced the longest tool life, best finish, and lowest chaser wear in threading this particular metal, and that heavier and lighter oils produced inferior results.

For the purpose of further shortening this discussion, therefore, I will try to confine our attention to corrosive cutting oils such as are commonly employed in the general machining of various types of steels, and will deal with oils having in every case the same viscosity and the same percentage of base where base is used. I am going to refrain from mentioning specific brands, but will, instead, identify the various types of oils commonly employed in the machining of metals as follows:

Sulphurized Mineral Oils,  
Mineral Oils plus Sulphurized Fat,  
Sulphurized Mineral Oils plus Sulphurized Fat,

Sulphurized Mineral Oils plus Chlorinated Base,

Mineral Oils plus Sulphurized Chlorinated Base,

Sulphurized Mineral Oils plus Sulphurized Chlorinated Base.

Straight Mineral Oils, Mineral-Lard Oils, and Straight Lard Oils will be eliminated from this discussion.

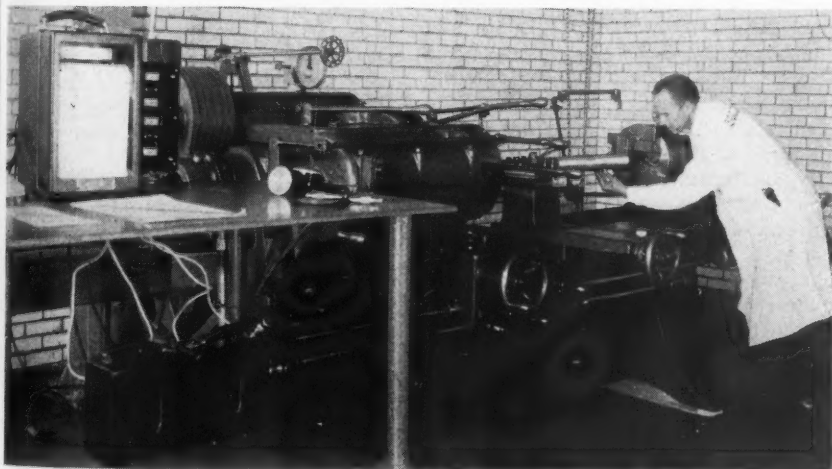


Fig. 1—Test Lathe with Auxiliary Equipment

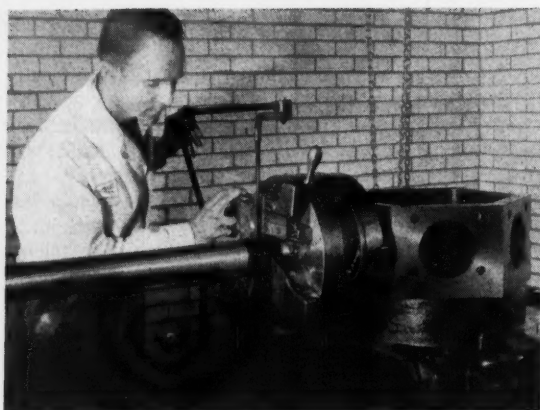


Fig. 2—Close View of Landmatic Die Head in Operation

If the flow of a chip were smooth and uniform, cutting pressures on a set of chasers would be constant. The plastic flow of the deformed material, however, is irregular and spasmodic, resulting in a rapid fluctuation of pressure that produces an effect on the lips of the chasers comparable to the pounding action of a sledge. In threading brittle and semi-brittle metals, this pounding is severe.

In threading ductile metals, such as the hot-rolled, low-carbon steels, the flow of the chip is smoother and the pounding action is less vigorous. In either case, the radial pressure on the ridges of the chasers is variable, ranging from zero to maximum. This pounding results in a microscopic vibration and consequently intermittent contact between the ridges of the chasers and the threads. Moreover, excessive frictional resistance between the lips of the chasers and the chips results in periodic seizure and thus magnifies this vibration.

The shearing of the chips from the workpiece destroys the structure of the metal adjacent to the cutting edges and results in the formation of built-up edges over which the rup-

tured chips slide. In cutting ductile metals such as the hot-rolled, low-carbon steels, a considerable build-up is formed on the lip of the tool, while in machining brittle metals like cast iron, the built-up edge may be practically non-existent.

When the pressures and temperatures developed during the threading operation are of sufficient magnitude, this destroyed material actually welds to the lips of the chasers. Even when no welding occurs, however, the built-up edge may be present as a more or less idle mass of material which alternately accumulates and sloughs away with the chip or between the chasers and the threads.

The protection which this structureless material affords to the cutting edges has an important influence

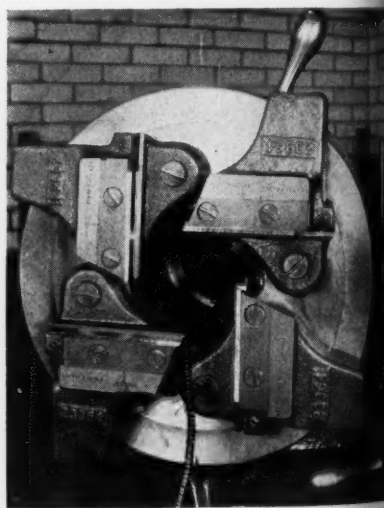


Fig. 3—Landmatic Die Head Open After Completing Threading Operation

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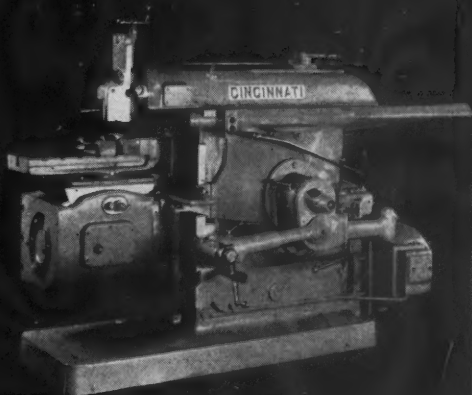
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on tool life. For example, a built-up edge of appreciable size localized the rubbing action of the chips, and consequently the maximum temperature, at an appreciable distance from the cutting edges. Due to this condition, wear makes its appearance in the form of a crater on the lips of the chasers. Thus the cutting edge is preserved and the life of the tool is pro-

when intermittent seizure between chips and chasers produces excessive vibration. Under these conditions a steeper rake angle makes it easier for the destroyed material to slide down the lip in the direction of chip flow.

The foregoing observations may be summarized as follows: the built-up edge that accumulates on the lip of a chaser serves to protect the cutting

edge and prolong the life of the tool. However, an excessive accumulation, caused either by a blunt rake or by intermittent seizure between the chip and the tool, results in some of the destroyed material passing between the chasers and the threads, resulting in a rough and unsatisfactory finish.

Tool life is usually measured by the number of machined parts that can be pro-

duced before the rim of the crater works its way to the cutting edge. When no built-up edge is present, the rubbing action localizes itself at the cutting edge. The latter condition occurs only in the machining of brittle metals which flake off as soon as they are compressed by the tool; thus the rubbing action at the cutting edge is more or less intermittent and consequently less severe.

Whenever the built-up edge accumulates more rapidly than it can slough away in the direction of chip flow, the excess tends to slough off between the chasers and the work, thus marring the finish, especially

duced before the chasers are worn to such an extent that regrind is necessary. This wear occurs on the lip and on the ridges. Due to the fact that there is no opening by which the lubricant can reach the lip surfaces adjacent to the cutting edge, there is no opportunity for cutting oil to lubricate these areas. The microscopic vibration of the tool, however, presents sufficient opening for cutting oil to reach the ridges, whence it can be drawn at least partially across the lip in the direction of chip flow.

The eventual appearance of a crater on the lip indicates the presence of a considerable accumulation

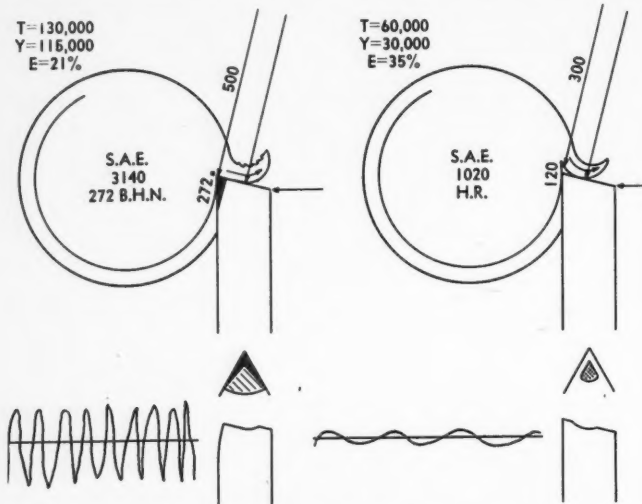


Fig. 4—Diagram Illustrating Cutting Pressures

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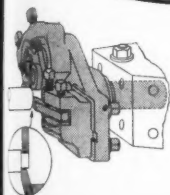
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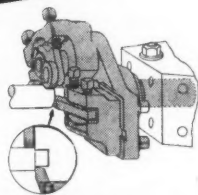
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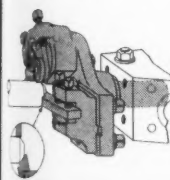
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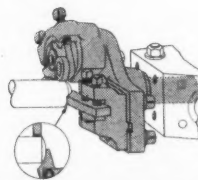
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Using a square cutter, this combination tool becomes a Single Cutter Turner. Note the rolls follow the cutter to burnish the work to a fine quality finish.



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of built-up edge, and consequently a substantial protection for the cutting edge. This is an ideal condition, provided a satisfactory finish is also secured. If the finish is not satisfactory, there is a strong probability that the accumulation of destroyed material is excessive and that there is a consequent sloughing between the ridges and the threads.

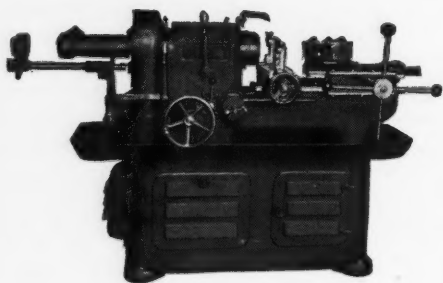
In the machining of soft, draggy steels, there seems to be an excessive accumulation of build-up. Under such conditions it is desirable to increase the anti-welding characteristics of the cutting oil in order to minimize the frictional resistance between the chip and the tool and thus permit a more ready sloughing with the chip. This addition, of course, has the effect also of decreasing the heat developed and further prolonging tool life. The addition of an excessive amount of anti-welding characteristics, however, usu-

ally permits such ready sloughing that the cutting edge is robbed of its protection and the life of the tool is unnecessarily shortened.

In the machining of semi-brittle steels, such as the cold-drawn or hardened bar stocks, the wear on the lip usually appears as a flattened area adjacent to the cutting edge. Under these conditions there is only a small accumulation of destroyed material, and consequently very little protection to the cutting edges.

The irregular and spasmodic flow of the chips produces a severe pounding action and, if seizure occurs between the chip and the tool, the vibration of the tool will be excessive. This excessive vibration will frequently permit the sloughing of the destroyed material between the nose of the tool and the workpiece, thus marring the finish. It is, therefore, important to maintain the meager pro-

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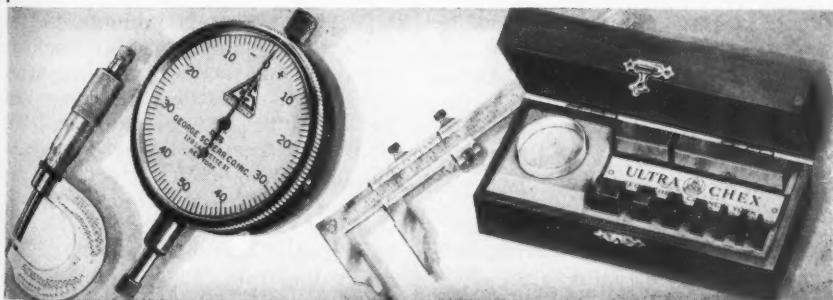


FIG. 1.



FIG. 2.

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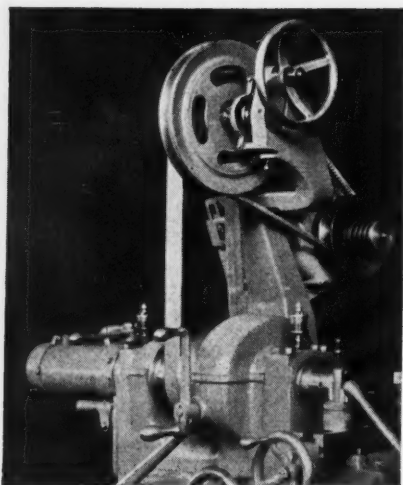
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tection afforded to the cutting edge by avoiding the use of any more anti-welding properties than are absolutely necessary for the promotion of smooth chip flow.

The cutting oils used for machining cold-drawn, low-carbon steels require very little of such ingredients. The cutting pressures encountered in the machining of cold-drawn, medium-carbon steels, however, are higher and require correspondingly increased amounts of anti-welding material in order to prevent seizure and minimize tool vibration. The same applies to hardened steels, the machining of which is accompanied by very high cutting pressures.

Again summarizing, it seems that in the machining of metals an important function of cutting oils is to control the magnitude of the built-up edge to such an extent that the cutting edge receives the protection necessary to reasonable tool life. At the same time, an excessive accumulation must not force destroyed material between the nose of the tool and the workpiece.

Another important function is to promote chip flow so that the vibration of the tool and the consequent sloughing action is minimized. Too little anti-welding material results in increased tool temperature and in excessive tool vibration, the former having the effect of shortening tool life, and the latter the effect of marring the finish. Too much anti-welding material promotes smooth chip flow to such an extent that the cutting edge is robbed of its protection, thus shortening tool life. Thus it would seem that there is an optimum of anti-welding characteristics for any machining operation.

This supposition is borne out by many instances in actual practice where the dilution of sulphurized cut-



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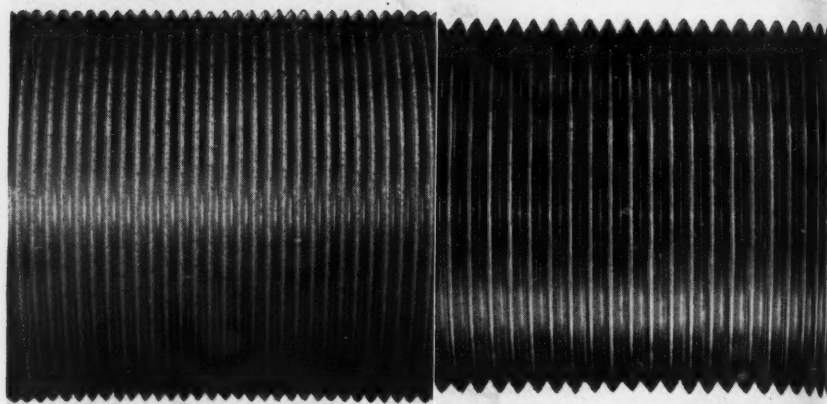


Fig. 5—(Left) "Sand-Blast" Finish Produced by Smackover 150—160 Seconds Viscosity Pale Oil  
Fig. 6—(Right) Finish Obtained with Sulphurized Mineral Oil Modified after 100 Minutes Operation, Just Prior to Tool Failure

ting oils with ordinary paraffin oil has materially improved performance. Frequently, where this has occurred, it has been said that the cut-back of paraffin oil has increased the cooling effect of the oil. This might be true if the cut-back were added to an oil of much heavier body, so that its fluidity was materially reduced. However, there are plenty of cases where the viscosity of the cutting oil has not been changed by the addition of the cut-back, although the performance was greatly improved.

The wear that occurs on the ridges of a chaser is perhaps even more important than the wear on the lip. The prevention of wear here is absolutely necessary to maintenance of both size and finish. Assuming that the microscopic vibration of the newly-ground tool is insufficient to permit the built-up edge to slough between the nose and the work, as soon as this portion of the tool wears appreciably the opportunity for sloughing is increased until the appearance of the finished surface indicates that a re-grind is necessary. Moreover, the increased

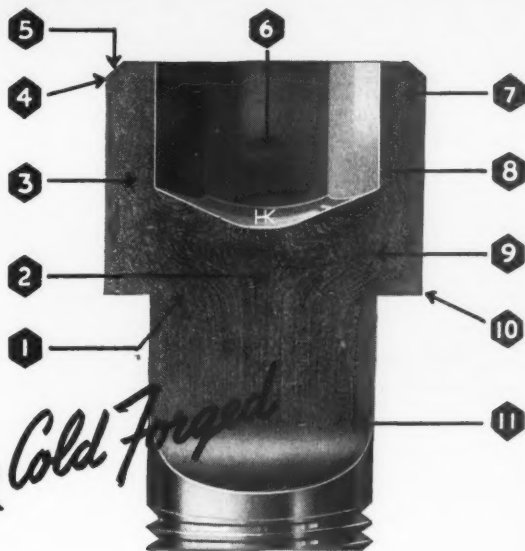
wear has had the effect of decreasing the depth of thread, so that the allowable tolerance is finally exceeded and the piece is rejected for both off-size and unsatisfactory finish.

The ridges of a chaser cannot be considered as an extreme-pressure area where anti-welding ingredients are effective. As a matter of fact, lubricity seems to be the important requirement in order to minimize the frictional heat developed during the rapid periodic contacts between the ridges and the threads. The ability of cutting oil to penetrate into this minute space is also essential in order that the lubricity ingredients may be able to do effective work.

Although tool life is usually measured by the number of machined parts that can be produced before the tool has to be re-dressed, this measurement should be considered as only the *apparent* tool life. The *actual* life of a cutting tool is more properly thought of as the number of pieces that can be produced before the chasers have to be scrapped. This latter conception takes into consider-



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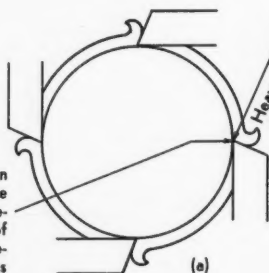
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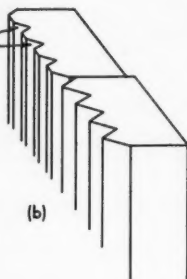
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Fig. 7—Drawing Illustrating (a) Points and Directions of Pressures and (b) Points at Which Wear is Found as Result of Lack of Oiliness and Polarity

Light-duty area between chaser and workpiece where pressure is due solely to deflection of chaser. Area of border line lubrication requires polarity and oiliness but no anti-weld.



Pronounced wear on ridges of chaser indicates lack of oiliness and polarity.



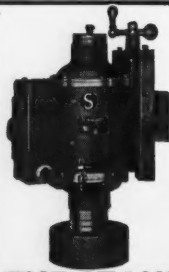
ation the amount of metal that must be ground away in order to properly recondition the tool.

For example, it is quite possible for two different cutting oils to perform on the same job with apparently equal results in the number of pieces per grind and at the same time produce widely different results in terms of chaser wear. In fact, it is not uncommon to encounter cases where it has been necessary to remove twice

as much metal from one set of chasers as from the other.

Probably the best example of such performance is the wear that occurs on chasers of the tangential type. Wear on the lip requires only a small amount of dressing in order to recondition the cutters, but wear on the ridges may require three or four times the amount of grinding before the chasers are in condition to cut again. Under these circumstances it would be quite possible for a cutting oil to have sufficient lubricity to protect the ridges, but inadequate anti-welding qualities to protect the lip, thus eventually producing excessive lip wear and vibration and resulting finally in a sloughing action that mars the finish.

At the same time it would also be possible for another cutting oil to have adequate anti-welding properties to protect the lip although sufficiently deficient in lubricity to cause excessive wear on the ridges, thus



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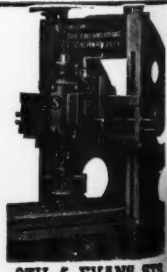
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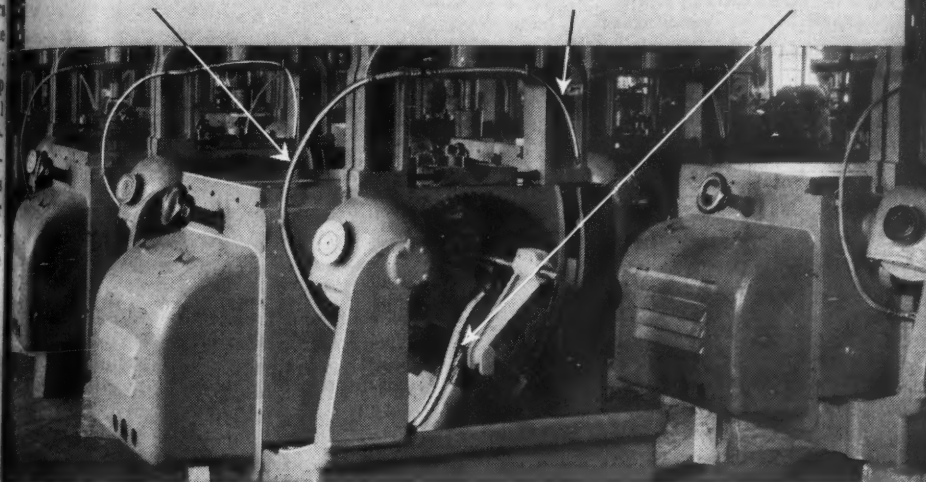
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permitting sloughing action that would likewise spoil the finish. Moreover, it is quite conceivable that these

lips of the chasers. Note drawing (a) in Fig. 7. These pressures are carried by extremely small areas, and may be as low as 200,000 lb. per sq. in., or as high as 400,000 lb. and over. Since no oil-film can withstand these pressures, actual metal-to-metal contact occurs between the chip and the tool.

Unless seizure is prevented, the irregular plastic flow of the chip produces a severe pounding action on the lip of the chaser and causes an excessive vibration that permits the

built-up edge to slough off between the chaser and the threads, thus producing a roughened finish. Moreover, unless welding of the built-up edge can be avoided, and unless this structureless material is kept flowing off with the chip, the excessive accumu-

**TABLE I**  
**Effectiveness of Corrosive and Non-Corrosive**  
**Oils having same viscosity and same**  
**percentage of base.**

**Threading 3140 Bar Stock (279 BHN)**

Type of Oil	Tool Life	Finish	Chaser Wear Per Min.
Corrosive . . . .	60 Min.	1.5	.0025"
Non-Corrosive	40 Min.	1.0	.0030"

oils might be capable of producing the same number of pieces before a regrind is necessary, while the amount of grinding on the chasers lubricated by the first cutting oil would naturally be very much less than the amount of grinding required on the chasers used with the second oil.

Thus, it seems that wherever excessive grinding is necessary in order to properly recondition a tool, the cutting oil employed is probably lacking in lubricity.

#### **Effect of Sulphur and Sulphurized-Fat**

The effectiveness of sulphur in cutting oils is two fold; (a) it serves to prevent

seizure between the chip and the lip of the chaser, and (b) it prevents welding of the built-up edge to the tool.

In threading carbon and alloy steels, ranging in hardness from 120 to over 300 Brinell, extremely heavy cutting pressures are exerted on the

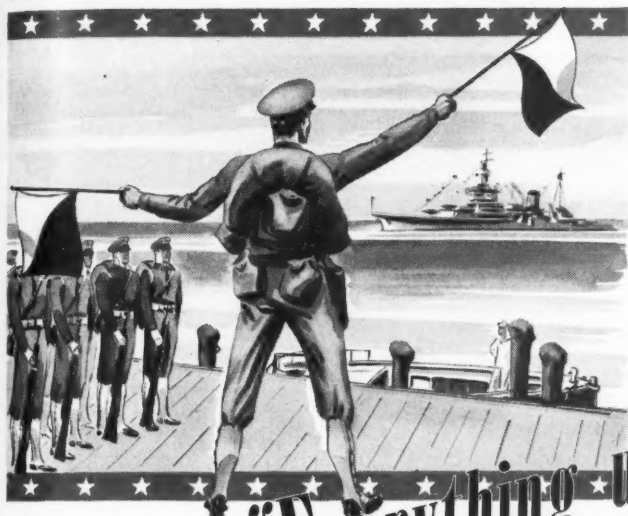
**TABLE II**  
**Effect of Viscosity**  
**with Corrosive Oils having same percentage**  
**of base.**

**Threading SAE 3140 Bar Stock (279 BHN)**

Type of Oil	Viscosity	Tool Life	Finish	Chaser Wear Per Min.
Corrosive ..	129"	60 Min.	1.0	.0025"
Corrosive ..	169"	80 Min.	1.5	.0017"
Corrosive ..	205"	18 Min.	1.5	.0065"

lation at the cutting edge will likewise result in its sloughing between the chaser and the threads, and thus marring the finish. The purpose of sulphur in cutting oils is to provide extreme-pressure characteristics that prevent seizure, and to supply anti-weld characteristics that keep the

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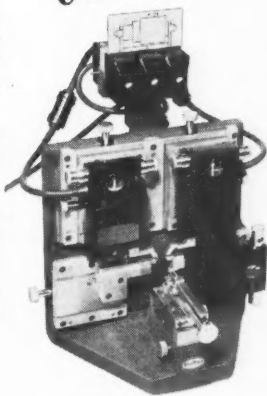
This panel carries an elevation drawing of the work piece with each critical dimension shown. A signal light is provided for each dimension.

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**TABLE III**

**Effectiveness of Natural Sulphur and Free Sulphur  
in Various Oils of Same Viscosity**

**Threading SAE 3140 Bar Stock (279 BHN)**

Type of Oil	Sulphur		Tool Life	Finish	Chaser Wear Per Min.
	%	Kind			
Straight Paraffin Oil	0.32	All Natural	2 Min.	0.5	.0510"
Straight Smack- over Oil	2.43	All Natural	54 Min.	1.0	.0023"
Sulphur- ized Min- eral Oil	3.16	1.66 Nat.	80 Min.	2.3	.0017"
		1.50 Free			

built-up edge mobile.

A cutting oil may contain three kinds of sulphur: (a) the natural sulphur of the petroleum oil, (b) the free sulphur that has been added, and (c) the sulphur that has previously been combined with fat. Although the natural sulphur in a cutting oil is more or less stable, it does have some effectiveness in preventing seizure and welding. The free sulphur that is added to sulphurized-mineral oils in the process of their manufacture, however, is very active and, therefore, more effective in counteracting cutting pressures.

The relative effectiveness of nat-

ural and free sulphur is shown in Table III, which presents the results of threading SAE 3140 bar stock (279 BHN) with a straight paraffin oil low in natural sulphur, a straight smack-over oil high in natural sulphur, and a sulphurized-mineral oil containing free (added) sulphur, but not much higher in total

**TABLE IV**

**Effectiveness of Free Sulphur and Sulphur Combined  
with Fat in Various Oils of Same Viscosity**

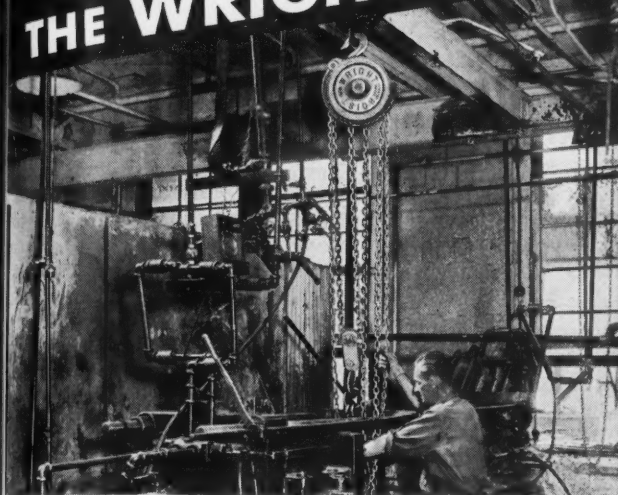
**Threading SAE 3140 Bar Stock (279 BHN)**

Type of Oil	Total Sulphur	Tool Life	Finish	Chaser Wear Per Min.
Sulphurized-Mineral Oil	3.16%	80 Min.	2.3	1.7"
Sulphurized-Mineral Oil and Sulphurized-Fat Base	4.30%	50 Min.	2.1	2.5"
Straight-Mineral Oil and Sulphurized-Fat Base	1.49%	90 Min.	4.3	1.5"

ural and free sulphur is shown in Table III, which presents the results of threading SAE 3140 bar stock (279 BHN) with a straight paraffin oil low in natural sulphur, a straight smack-over oil high in natural sulphur, and a sulphurized-mineral oil containing free (added) sulphur, but not much higher in total

sulphur than the smackover. The smackover oil, high in natural sulphur, out-performed the low-sulphur paraffin oil, but the sulphurized-mineral oil greatly out-performed the other two in every respect—tool life.

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finish, and chaser wear.

Sulphurized-mineral oils are somewhat handicapped, however, in the matter of lubricity. Where lubricity is required, as well as anti-weld characteristics, the addition of a sulphurized-fat base not only provides this lubricity, but also materially increases the extreme-pressure characteristics of the oil. In fact, in the threading of fairly clean-cutting, semi-brittle stocks where the built-up edge is very small, the addition of a sulphurized-fat base to a sulphurized-mineral oil may increase the extreme-pressure and anti-weld characteristics enough to practically eliminate the built-up edge.

**TABLE V**  
**Effectiveness of Chlorinated and Chlorinated-Sulphurized Bases In Straight-Mineral and Sulphurized-Mineral Oils of Same Viscosity**

**Threading SAE 1020 Bar Stock (122 BHN)**

Type of Oil	Tool Life	Finish	Chaser Wear Per Min.
Sulphurized-Mineral Oil	50 Min.	3.0	.0010"
Sulphurized-Mineral Oil and Sulphurized-Fat	79 Min.	6.7	.0003"
Straight-Mineral Oil and Sulphurized-Fat	20 Min.	1.0	.0004"
Sulphurized-Mineral Oil and Chlorinated-Base	72 Min.	5.1	.0008"
Straight-Mineral Oil and No. 1 Chlorinated Sulphurized-Base	86 Min.	5.9	.0003"

Thus robbed of its protection, the cutting edge of the tool breaks down quickly as shown by the records of tool life, finish, and chaser wear indicated in Table IV. When a sulphurized-fat base is added to a straight-mineral oil, however, the required lubricity is provided without robbing the cutting edge of its protection by the use of too much sulphur. Tool life, finish, and chaser wear are thus materially improved.

Although an unusual amount of attention has been given in recent years to the study of the built-up edge and its influence on tool life and finish, there is still plenty of work to be

done before mere theories such as these can be accepted as the explanations for observed results. Moreover, much research work still remains to be done to determine the effectiveness of various types of stocks employed in the manufacture of cutting oils. It is a matter of common knowledge, however, that chemical analysis alone is not an indication of the probable performance that can be expected.

For example, such an analysis may show that an oil contains 3½ per cent of sulphur, but it does not state how much of this is natural sulphur, how much is free added sulphur, and how much is combined

## New Convenient Drill Grinding Combination

### Sellers No. 1G Drill Grinder with steel cabinet pedestal

A new convenience for operators engaged in drill grinding is the steel cabinet pedestal now furnished with the Sellers Model 1G Drill Grinder. It forms a firm, substantial pedestal for the grinder and the work, and a handy cabinet in which to store supplies and attachments. Cabinet and grinder may be purchased separately, if desired.



The Sellers Model 1G Drill Grinder will grind drills from No. 70 (.028") to  $\frac{1}{2}$ " and produces accurate drill points of 160 to 65 degrees included angle—perfect drill points with equal identical lips. Speeds production. Saves skilled labor for production machine work. Saves drills. Write for catalog and prices.

The cabinet has a working space 13" wide by 30" long and stands 31" from the floor. It is of heavy sheet steel, rigidly constructed and braced to form a vibrationless mount for the grinder. There are three shelves of wood (to avoid defacing tools) with a hinged door and fastener. Finish is standard machine tool gray. Weight 175 lbs.

WM. SELLERS & CO., INC. • 1614 Hamilton St., PHILADELPHIA, PA.



# Sellers

with fat. It is quite possible to match such an oil exactly and still not produce a product that will give a comparable performance. This and similar reasons emphasize the uselessness of attempting to match cutting oils on the basis of chemical analysis and the folly of attempting to select cutting oils on the basis of specifications.

(The second part of this article will be published in the July issue.)

**Wayne Folder Catalog.** Wayne Chemical Products Co., 9448 Copeland Ave., Detroit, Mich., is now issuing a catalog containing a convenient pocket for filing folders, bulletins, and so on, on the company's various products including Protex Non-Rust Oils and Coatings, Aqua-Sol Grinding, Honing, and Lapping Compounds, Nonscratch Drawing Compounds, Nosep Lubricant, technical tallows, metal warp coatings, Spatter-Ex and Flash-Ex Compounds, white layouting coating, tube drawing compounds, Meltomatic Paste Solder, Zeto-Sol Water

Soluble Cutting Compound, spray booth cleaners, 3B Lubricant, Dri-Lube Powdered Lubricant, and so on. Copy free upon request.

**Cross Machine Tools.** Cross Gear & Machine Co., Detroit, Mich., has prepared a portfolio containing a series of bulletins illustrating and describing the Cross No. 36 Gear Tooth Rounder, No. 40 and 41 Gear Tooth Pointing Machine, No. 50 Universal Gear Chamfering Machine, No. 60 Gear Tooth Pointing Machine, and Series 70 Gear Burring Machine.

Various applications photographs of these machines together with a complete list of specifications are included in each bulletin. The portfolio also contains a bulletin illustrating and describing the Cross Wheel Dresser for forming various types of grinding wheels and the Cross Cutter Grinding Attachment for sharpening gear tooth rounding or chamfering cutters, taps, and so on.

Copy of Cross Machine Tool Portfolio will be sent free of charge to any mechanical executive addressing a request on his company letterhead.

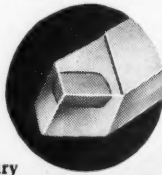
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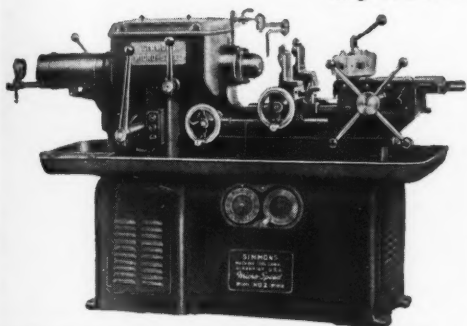
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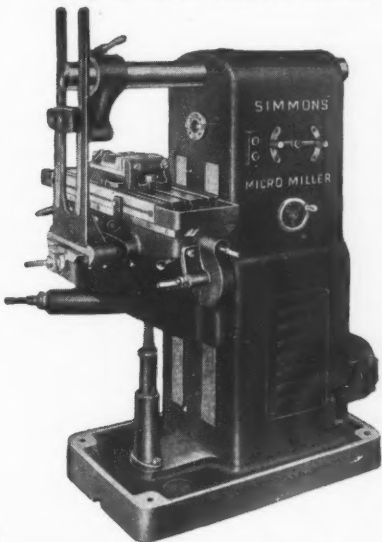
**THIS NEW No. A-1 MILLER** is ideal for any plant or shop producing numerous small parts. It is the perfect tool for aircraft use and for all vocational training purposes.

An important feature is the SIMMONS MICRO-SPEED DRIVE, the variable speed unit which has proved so successful in the new Simmons turret screw machines and lathes.

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*Write for Descriptive Bulletin.*

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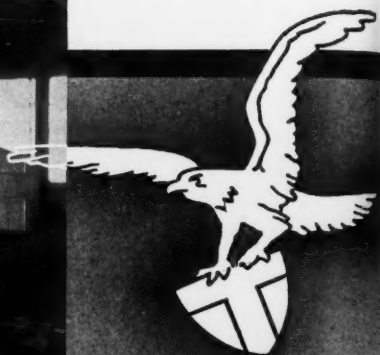


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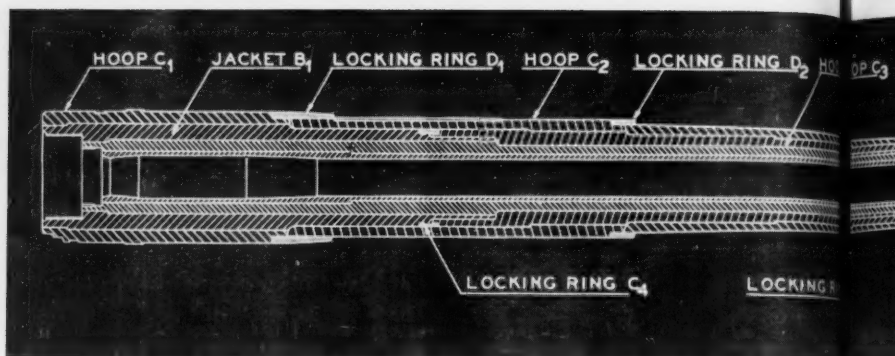


Fig. 1—Cross Section of Large Gun Barrel, Showing the Strands of

**T**HE big guns which comprise an important part of our country's defenses are always interesting, even in peace-time, and our interest in them increases in times of national peril. But, aside from our dependence upon them as an effective means of protection against unfriendly powers, there is something fascinating about the suddenness with which an apparently lifeless, inert piece of steel awakes from its lethargy to hurl an immense steel shell at a foe which

## Big Guns and Ma

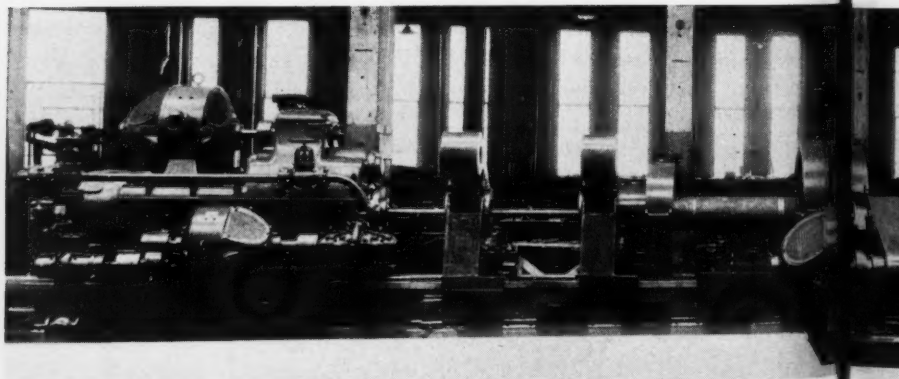
By G. A. SPOONER, G

may be many miles away.

The shock accompanying this intense activity causes tremendous stresses to be exerted, and the development of a gun that can stand these strains has been slow indeed. The process of evolution leading up to the ordnance in use by our forces today has covered several centuries and has

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Fig. 2—Tube Lathe Boring a Test Piece. Each Bar



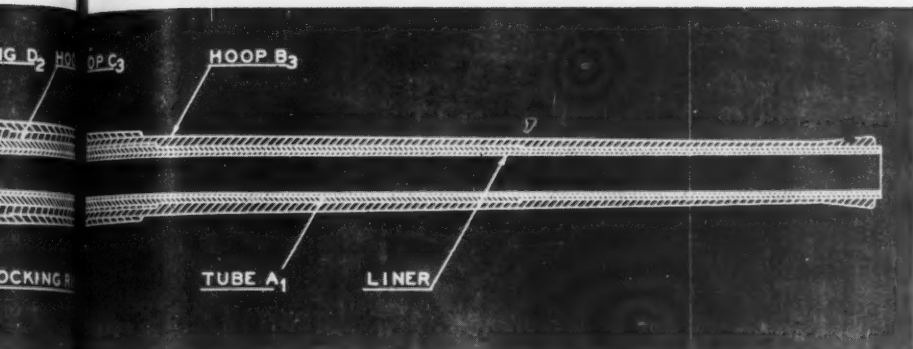


Fig. 1. Cross-section of Liner, Tube, and Hoops, All Made from Forgings

# Machine Tools

G. A. Spencer, General Machinery Corporation

Increasingly called for the ingenuity of the gun designer, the steel maker, the metallurgical chemist, and others. Of particular interest to us is the fact that the gun designer has continually demanded larger, heavier, and more accurate machine tools. After all, no gun can be better than the tools with which it is created.

A large-caliber gun is built up of several cylinders, made from forged steel and known as the liner, tube, and hoops. A casual inspection of the various parts will show them all to be cylinders of various lengths and diameters, which accounts for the various sizes of machine tools required to make the parts. In general, the machine used to make large diameter hoops can be comparatively short while the machine for the small diameter parts will be quite long.

Each Roll is Driven by a 25 H.P. Motor with 4:1 Gear Ratio.

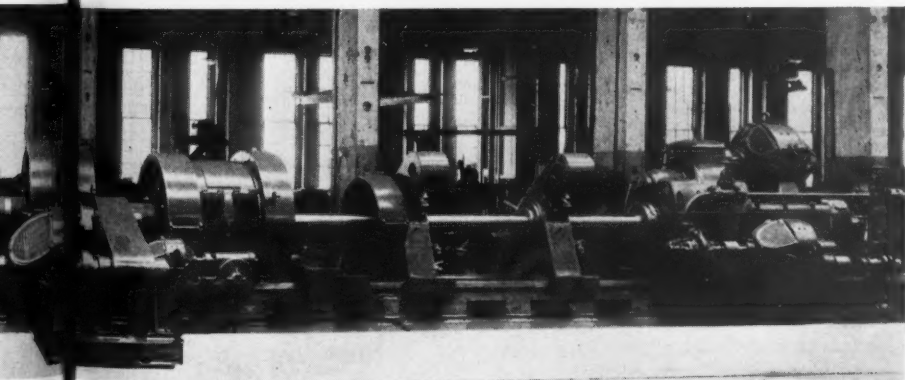




Fig. 3—Typical and Rough Boring Lathe for Gun Tubes. Overall Length, 200 Feet. It will Accommodate a Work-piece 61 Feet Long by 24 Inches Diameter

In order to withstand the tremendous strains resulting from the explosion, without excessive expansion of the liner, the gun is constructed on the principle known as "initial tensions." The hoops are smaller in internal diameter than the outer diameters of the inner members, which cause permanent compression forces in the inner members that must be overcome before any expansion strain can be transmitted to the various other parts of the gun.

Two types of special tools—the turning lathe and the boring lathe—

have been developed to machine the hoops, tube, and liner. In some cases both types have been combined in one machine. A typical rough-turning lathe for the jacket and hoop gun forgings will swing a work-piece 84 inches in diameter and 30 feet long over the carriages. Such

machine is shown in Fig. 3.

The machine shown is a double-end rough boring lathe for gun tubes, which ordinarily start out as solid forgings.

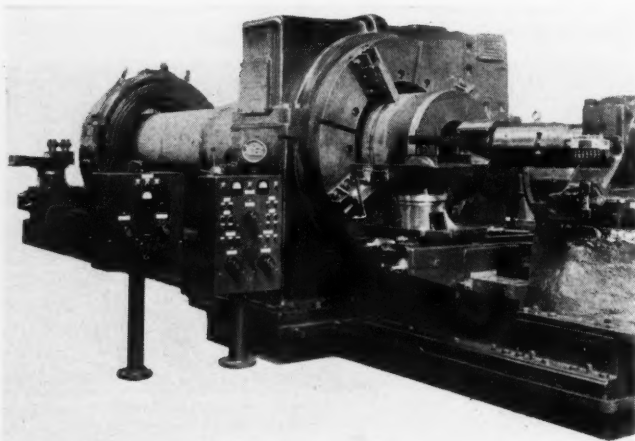


Fig. 4—Driving Mechanism of 43-Inch Boring Lathe. This machine will Bore Work up to 46 Feet Long and 40 Inches Diameter

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June, 1941

As shown, the boring bars are not installed. The overall length of the machine is 200 feet, and the center drive is powered by a 75 h.p., 4:1 ratio adjustable speed motor. The forging is clamped in the center driving head and the ends are supported in the rotating steadyrests which can be located at any point on the bed most suitable for the length of forging. The maximum size of work that can be accommodated is 61 feet long by 21 inches diameter.

In the 43-inch boring lathe, the carriage is used to spot the work preliminary to the boring operation. The machine will bore a workpiece as much as 46 feet long and 40 inches diameter. If a cut in process becomes too heavy or the machine is otherwise overloaded, an adjustable relay causes a bell to ring, thus warn-

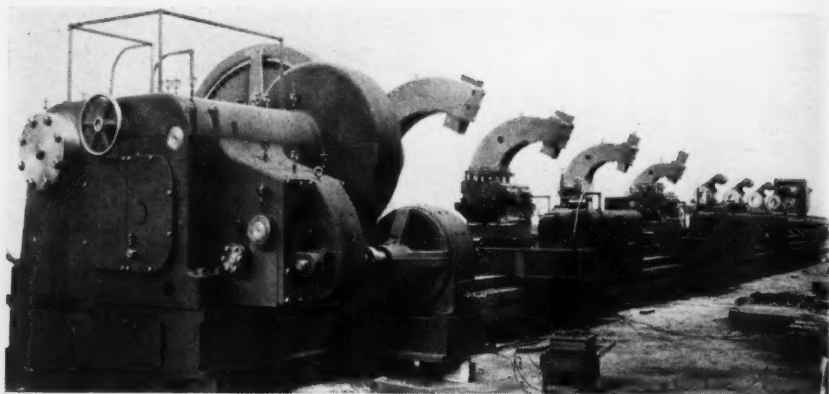


Fig. 5—Finish Turning and Boring is done on this Lathe, Which will Accommodate Barrels up to 87 Feet Long and 84 Inches Outside Diameter

ing the operator so that damage to the equipment can be prevented. Centralized control for all of the machine is provided by the push-button panel located convenient to the end of the workpiece.

The gun is built up by fitting the jacket over the tube and then following with the hoops, building one upon another at the breech where the greatest strength is needed to withstand the shock of the explosion. Inasmuch as the inner diameter of the jacket is smaller than the outside diameter of the tube, in order to assemble the parts it is necessary to expand the jacket by heating, and contract the tube by cooling, until the

jacket can be slipped over the tube. The other hoops are assembled to the jacket in the same manner. The permanent strains in the assembled gun are obviously dependent upon the accuracy of the machining on the various parts. Most tolerances are not over 0.001 inch.

After the gun has completely been assembled, it is placed in a lathe, as shown in Fig. 5, for finish turning and boring. This lathe can be used to machine a gun of 20-inch caliber, with an outside diameter of 84 inches and length of 87 feet. The lathe is 212 feet long and weighs 421 tons, yet will finish a gun-bore to within 0.002 inch oversize and 0.000 under-



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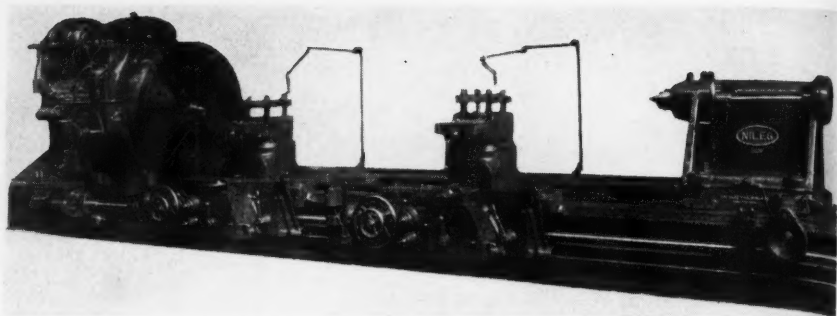


Fig. 6—Small Guns up to 6-Inch Caliber are Turned Out in this Lathe. The 60-Inch Faceplate is Driven by a 50 H.P. Induction Motor

size. Power for the faceplate and feed drive is supplied by a 100-h.p. motor.

The smaller guns in the large range, including the 6-inch caliber, are each made from a single forging or centrifugal casting. The gun is turned on a lathe, as shown in Fig. 6. This particular lathe has a 60-inch

faceplate driven by a 50-h.p. induction motor which also provides feeds for both carriages. A separate motor on each carriage supplies power for rapid traverse. There is no clutch in the main drive, quick stopping being accomplished by plugging the motor. The motor can be started or stopped from either carriage.

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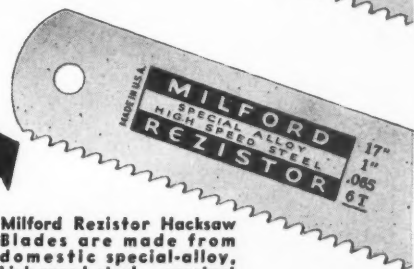
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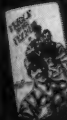


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THE HENRY G. THOMPSON & SON CO.

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A double-end boring lathe of the hollow spindle type is shown in Fig. 7. The gun is rough-bored in this lathe, in which operation the gun is revolved in one direction while the boring bars are fed in the other direction. High pressure coolant is forced through oil-holes in the boring bars to cool the cutters and wash the chips away. The 30-h.p. 575/1725 r.p.m. main drive motor is controlled and the boring bar tailstocks are fed or rapid traversed from control levers at the front of the bed. The feed is powered by the main drive motor, and fast traverse is supplied by a 7½-h.p. motor. Movement and direction of feed are controlled through a motor-shifted clutch. This lathe is also suitable for finish boring from one end.

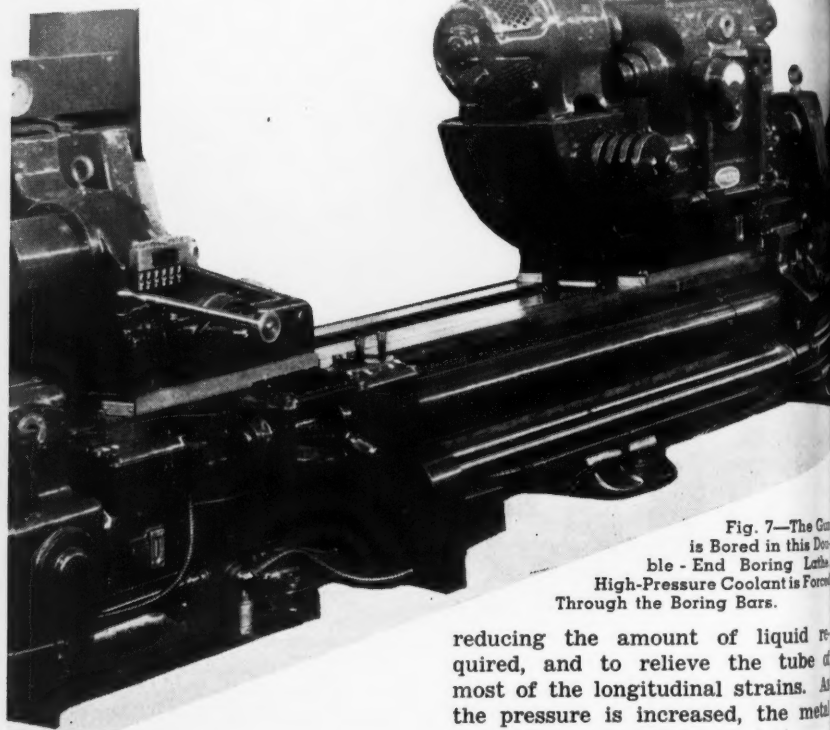


Fig. 7—The Gun is Bored in this Double-End Boring Lathe. High-Pressure Coolant is Forced Through the Boring Bars.

reducing the amount of liquid required, and to relieve the tube of most of the longitudinal strains. As the pressure is increased, the metal

Some of the boring bits used in the machining of the large guns are shown in Fig. 8. The tool at the right is used for rough boring, the center bit for semi-finishing, and the one at the left for finish-boring. The packing for the semi-finishing and finish boring bits is of seasoned hardwood and is slightly larger than the cutter diameter. The packing guides the cutter and thus ensures an accurate bore.

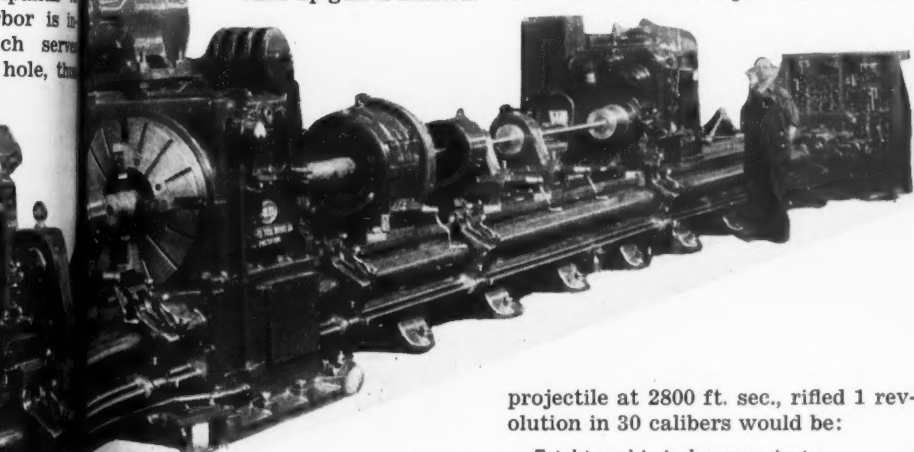
After the gun has been bored and turned to approximate dimensions, it is subjected to a high internal hydraulic pressure which expands it. During this process an arbor is inserted into the hole which serves both to practically fill the hole, thus

used in the guns are at the right of the center of the one at the left. The pack and finish of the hardwood guides the cutter in an accurate hole, the

closest to the bore expands to a point past its elastic limit, thus taking a permanent set. The outer metal is still below its elastic limit, so when pressure is released, the outer metal tries to contract to its initial diameter. However, it is restrained by the metal which has set, which results in permanent internal strains similar to those in a built-up gun. However, the construction is actually stronger because the number of steps or "hoops" in this gun is infinite while the number of hoops on the built-up gun is limited.

operation consists of cutting a series of small spiral grooves in the bore surface in order to start the projectile rotating as it leaves the gun-barrel, so that it will follow a true course and be steady in flight. As a general rule, the depth of the grooves is equal to  $\frac{1}{2}$  to 1 per cent of the caliber (bore diameter) and in number are about six times the caliber, although this is not a fixed rule.

Reference to the amount of "twist" usually means the number of calibers travelled by the projectile for one revolution; for example, one turn in 25 calibers. The r.p.m. of a 6-inch



projectile at 2800 ft. sec., rifled 1 revolution in 30 calibers would be:

R.P.M. equals	Total travel in inches per minute		
	(Number of inches traveled per revolution)		
	(2800)	(12)	(60)
	or	(30)	(6)
	or	11,200 r.p.m.	

This process of expansion is known as "autofrettage" or "self-hooping" process. Different pressures are used, depending upon the thickness of metal in the various parts of the gun. After completion of the pressure application, the gun is rough-bored and turned and then the finish cuts are taken.

The gun, whether of the built-up type or made by the Autofrettage process, is now ready for rifling. This

The twist can be either "uniform" where the grooves follow a constant spiral, or "increasing" where the grooves have little or no twist at the powder chamber end but have a progressively greater twist toward the muzzle.

Originally "uniform twist" was used altogether, but, due to the fast-

7—The Gun in this Drawing Labeled is Forged.

liquid re- tube of rains. As the metal



Fig. 8 — Boring Toolbits Used for Machining Large Guns. The Bit at the Right is for Rough Boring, the Center Bit for Semi-Finishing, and the one at the Left for Finish Boring.

burning powder, resulted in excessive wear at the origin of the rifling. This led to the use of "increasing" twist, which reduced the wear at this point. Present-day slow-burning powder and knowledge of gun manufacture have, however, greatly reduced the advantages of "increasing" twist.

An example of the type of machine used for rifling the gun barrel is shown in Fig. 9. This particular tool will handle up to 20-inch bore diameter and 82 feet long. It is about 208 feet long and is powered by a 40-h.p., 200/1200 r.p.m. planer-type motor geared so that the rifling bar speed

can be adjusted to between 9 and 84 feet per minute. A 5-h.p. pump motor supplies high pressure coolant to cool the tools and wash away the chips.

The preliminary set-up to rifling the gun is to set the "former ribbon" to the desired position. As the rifling bar is moved forward, it is rotated by a rack that is moved by the forming ribbon and meshes with a gear on the bar. A planer-type tool on the front bar support is used to cut a groove in the bar to be used as a guide to turn the bar when the rifling operation is in process.

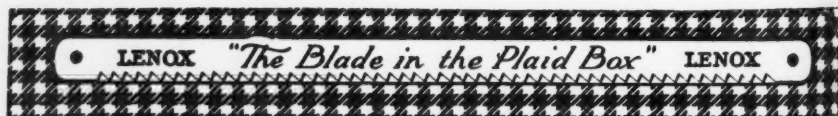
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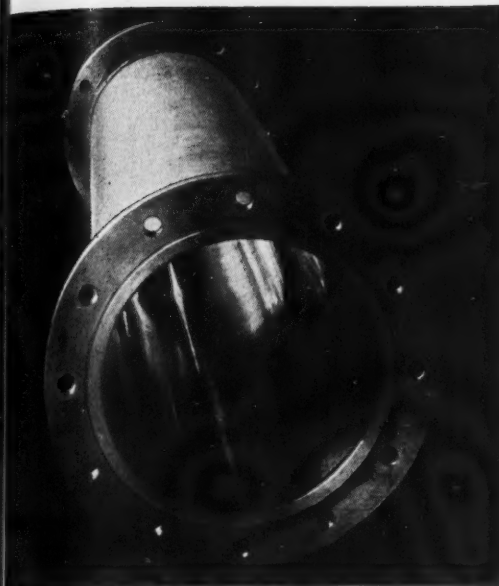
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16 in. x 7 ft. honed cylinder

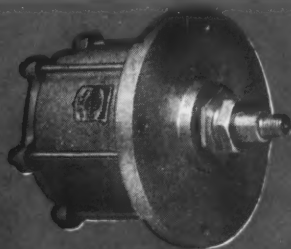
## The Inside Story of Air Cylinder Performance

Continuous production makes details of pneumatic cylinder design and performance increasingly important—and Hannifin Cylinders give you the features that mean maximum use of air power with no leakage, minimum friction loss, and simplest maintenance.

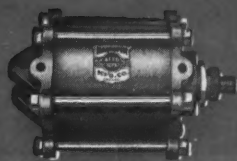
All Hannifin Cylinders, even the largest sizes, are bored and then honed, giving a cylinder bore that is straight, round, and perfectly smooth. The original high efficiency piston seal can be easily maintained throughout the entire life of the piston packing. The soft, graphite-treated piston packing is adjustable in a few minutes, from the outside of the cylinder, without disturbing any other parts. The piston can be repacked, in an emergency, with ordinary graphited packing, always available. No special parts are required.

Hannifin Pneumatic Cylinders are built in a full range of standard mounting types, sizes 1 to 16 in. diameter, for any length stroke. Both single and double acting types, with or without air cushion. Write for Cylinder Bulletin 34 with complete specifications.

**HANNIFIN MANUFACTURING COMPANY**  
621-631 South Kolmar Avenue • Chicago, Illinois



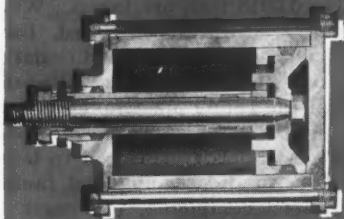
Model JR  
double-acting  
cylinder



Model BR  
double-acting  
cylinder



Model CR  
double-acting  
cylinder



Sectional View

# HANNIFIN

## PNEUMATIC CYLINDERS

June, 1941

MODERN MACHINE SHOP 117

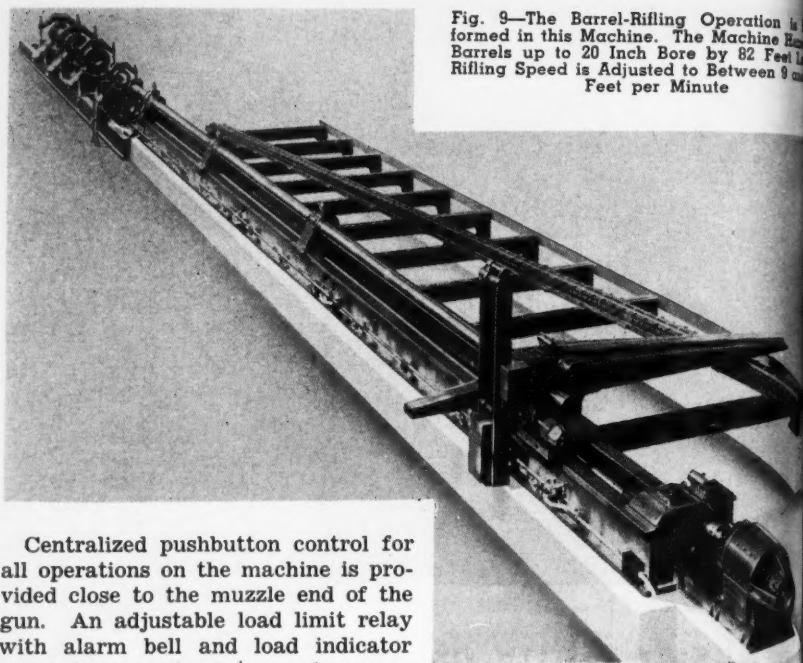


Fig. 9—The Barrel-Rifling Operation is formed in this Machine. The Machine Rifles Barrels up to 20 Inch Bore by 82 Feet in Length. The Rifling Speed is Adjusted to Between 9 and 12 Feet per Minute

Centralized pushbutton control for all operations on the machine is provided close to the muzzle end of the gun. An adjustable load limit relay with alarm bell and load indicator warns the operator in case of any unusual load on the drive motor.

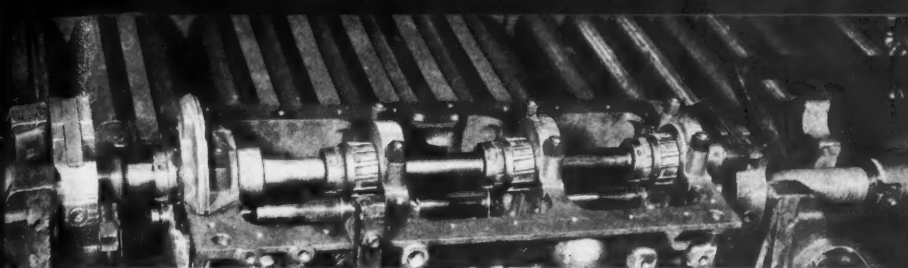
Several grooves are cut simultaneously in a manner similar to the operation of a planer except that the tools move and the work is held stationary. Very light cuts of from 0.001 to 0.0015 inch are taken. When a set of grooves is completed, the rifling bar is indexed and additional grooves are cut. This process is repeated until the rifling operation has been completed. The gun is now finish-turned and the ends are faced to length.

With the turning and facing operations completed, the point of least droop is determined and a keyway is cut so that a key can be inserted into the slide cylinder to prevent the gun from turning. The yoke is now put on and the gun is ready to speak its piece for all the world to hear and note that it has now become an integral part of our national defense.

**Grobet Catalog DSB-27.** Issued by Grobet File Corp. of America, Park Road, New York, N. Y., this catalog covers a complete line of small burs or cutters with  $\frac{1}{8}$  and  $\frac{3}{16}$ -in. capacity. The burs can be obtained in fine cut for use on steel and coarse cut for use on cast metals and plastic materials. Copy of Catalog DSB-27 free upon request.

**Yoder Metal Working Equipment** for steel mills, automotive factories, aircraft industries, structural shops, sheet metal workers, and so on, is the subject of an eight-page illustrated bulletin published by The Yoder Co., 5500 Woodward Ave., Cleveland, Ohio. Equipment covered includes various types and sizes of roll forming machines, flycut-off machines, rotary gang shears and side trimmers, tube mills, and miscellaneous and special equipment such as rotary and circle shears, high speed metal forming hammers, cam type bending machines, scrap flattening rolls, garnish moulding benders, and so on. Copy of bulletin free upon request.

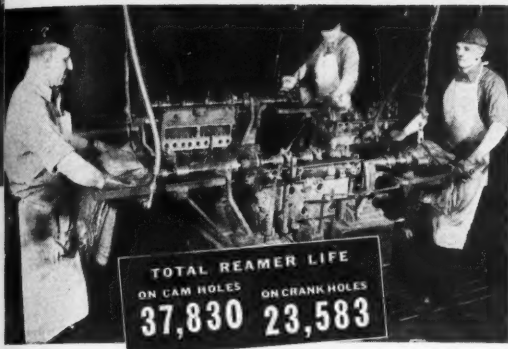




# BARBER-COLMAN INSERTED BLADE LINE REAMERS

## ON MOTOR BLOCKS

*Give*—Accurate Holes  
—True Alignment  
—Long Tool Life



### THE FIGURES

Tools — Barber-Colman Inserted Blade Line Reamers.

Part — Automobile cylinder block . . . . . Material — Cast Iron.

Operation — Reaming 4 crankshaft and 4 camshaft holes as follows: Crankshaft, 2.407" diameter . . . . . Camshaft No. 1 — 2.130"; No. 2 — 2.0995"; No. 3 — 2.068"; No. 4 — 1.2455".

Holding Method — Special fixture locating from top of block.

Speed — Surface feet per minute: Camshaft Line Reamer, No. 1 — 46.3 ft.; No. 2 — 45.5 ft.; No. 3 — 44.8 ft.; No. 4 — 27.2 ft. . . . . Crankshaft Line Reamer, 27 ft.

Feed — Screw on arbor . . . . . 0.093" per rev. for camshaft holes; 0.107" for crankshaft holes.

Production Time — 2 minutes floor-to-floor.

Accuracy — Holding better than drawing tolerances:  $\pm 0.0005$ " for camshaft holes;  $\pm 0.00025$ " for crankshaft holes. Smooth finish without tool marks.

Reamer Pieces per	Cams 1261	Number of	Cams 30
Life — Sharpening	Cranks 1123	Sharpenings	Cranks 21
Total Reamer Life	Cams 37,830		
	Cranks 23,583		

**USE BARBER-COLMAN COMPLETE REAMER SERVICE**  
B-C Complete Reamer Service includes a wide variety of line and individual Inserted Blade Reamers, standard and special Fluted Reamers, and highly precise Reamer Sharpening Machines — all described on pages 144-169 in your B-C Catalog K. Order future requirements now. If you have an unusual reaming problem consult Barber-Colman Engineering Service.

These reaming operations on the motor blocks of a leading automobile show how Barber-Colman Inserted Blade Reamers produce accurately aligned cam and crank shaft holes with low tool cost.

Cam and crank shaft holes are reamed at the same time in the manner illustrated above. The figures tell the story of their remarkable performance. *Speed* — one block every 2 minutes floor-to-floor. *Precision* — holding better than drawing tolerance of  $\pm 0.00025$ " on crank holes;  $\pm 0.0005$ " on cam holes. *Finish* — smooth, no tool marks. *Reamer life* — averages 1261 cam holes per sharpening; 1123 crank holes; totals 37,830 and 23,583 respectively. B-C Reamers are also used on the babbitt bearing liners.

Results like this are routine with manufacturers using B-C Inserted Blade Reamers, which have established new high standards for reaming in many plants. Experience indicates that similar opportunities may exist in your plant to improve operations and save with B-C Reamers.



A Barber-Colman Inserted Blade Line Reamer of the general type used on the above job. These are made to order for specific requirements.

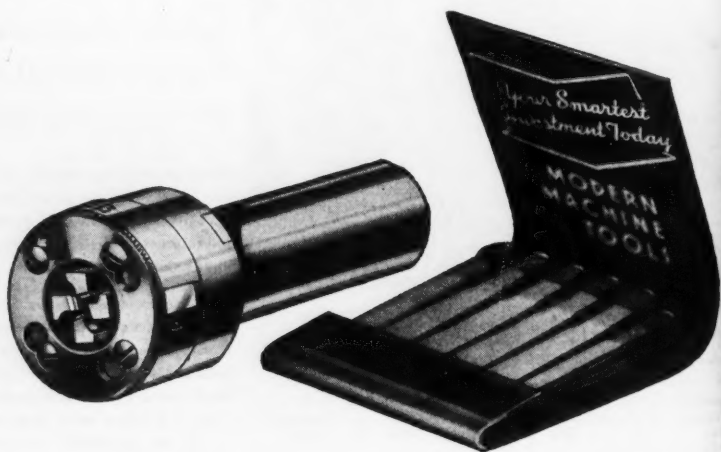


## Barber-Colman Company

General Offices and Plant 207 Loomis St., Rockford, Illinois, U. S. A.

# Have You a Copy?

## New Booklet EJ5 Die Heads



Pictured above is shown actual size the Geometric 3/16" EJ5 Solid Adjustable Die Head. This is just the tool you need for those small diameter, fine pitch threads from No. 0 to No. 10 diameters, 100 threads per inch or coarser.

Don't you want a copy of the brand new booklet on this tool? It's yours for the asking.

## The Geometric Tool Co.

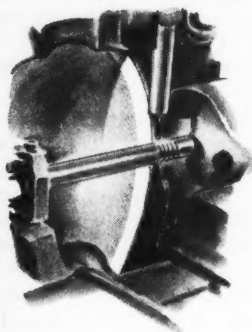
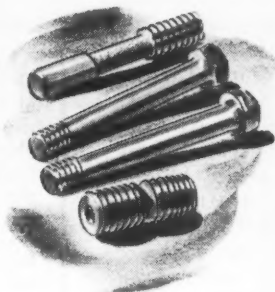
NEW HAVEN, CONN.

## What holds a dive bomber together at 500 M.P.H.?



The answer is design and construction and materials and craftsmanship. But accuracy and finish of parts are also important in building a plane to withstand terrific speeds and that depends on grinding. Vibration is minimized by grinding all moving parts of the power unit to extreme accuracy. Safer and stronger threaded parts are ground with special grinding wheels such as are made by The Carborundum Company.

Grinding of threads from the blank is a comparatively new development. Threads that are ground to an almost unbelievable accuracy, free from microscopic checks and cracks! Grinding wheels for airplane manufacture constitute only one of many contributions made to industry by Carborundum during its fifty-year existence.



Carborundum manufactures and can specify the right wheel for every grinding job. And Carborundum engineers will gladly show you the best methods of using these wheels for higher production, improved quality of work and lower costs. Write The Carborundum Company, Niagara Falls, N.Y.

Carborundum is a registered trade-mark of and indicates merchandise by The Carborundum Company.



# Defense Contract Service

## *An Appeal to Every American Manufacturer*

**I**N JUNE, 1940, as the vaunted army of the French Republic was crumbling before the onslaught of mechanized aggressors, the greatest industrial nation on Earth began in earnest the grim task of building an unbeatable military machine. The fall of France was the signal for Congress to appropriate billions for rearmament. Swiftly the Army and Navy placed huge orders. Of necessity, most of them went to large firms that had the managerial, engineering, and factory personnel to translate orders of such type and magnitude into terms of plant facilities, manpower, and materials.

Now every suitable factory in the country—large and small—must be enlisted. Only in that way can we make more weapons NOW for the defenders of democracy. It is the only way to get out the additional orders

that are in the making. They must be filled in record time.

Thousands of manufacturers whose useful machines are now idle or could be made available are asking what

they should do to help. The answer is this: Write or go to the regional office of the Defense Contract Service at the Federal Reserve Bank or branch bank which serves the region in which you live. Send or take with you the information outlined here.

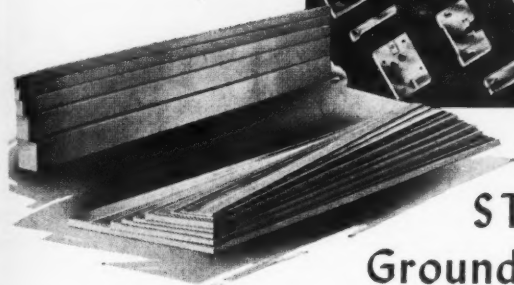
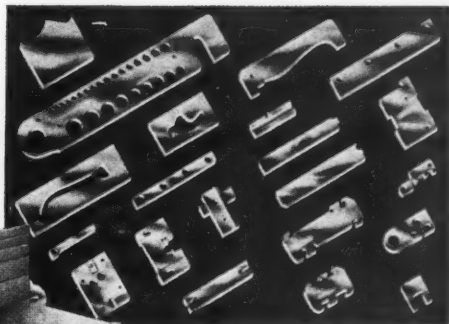
The Defense Contract Service has been set up

by the Office of Production Management, with the cooperation of the Federal Reserve System, to help democracy work swiftly. It provides a clearing house of information—close to home—for prospective contractors and subcontractors, for Army and Navy procurement officers in the field, and for firms that now

**WILLIAM S. KNUDSEN**, Director-General of the Office of Production Management, recently said, "Every machine shop and foundry in the United States which can make even a piece of something must be enlisted for the duration of the war." Thousands of manufacturers with useful equipment are asking what they can do to help, and it is to help these manufacturers that this appeal from the Production Division of the OPM is, in part, reproduced here.

# THIS IS NO TIME TO WASTE TIME

MAKING PARTS  
LIKE THESE



Use  
**STARRETT**  
Ground Flat Stock

Don't tie up men and machines grinding stock for small parts, tools, gages, etc. Keep a supply of Starrett No. 495 Ground Flat Stock in the crib. It comes in 18-inch lengths in a complete range of widths and thicknesses. Made of first quality tool steel, cut

lengthwise from the sheet, ground to within .001" of size and annealed for easy machining. Each piece individually packaged and marked for quick identification. Write for special Ground Flat Stock Folder MD and for a handy reference wall chart.

**THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.**

*World's Greatest Toolmakers*

Precision Tools . . . Dial Indicators . . . Ground Flat Stock . . . Hacksaws . . . Metal Cutting Bandsaws . . . Steel Tapes

*Starrett*  
**GROUND FLAT STOCK**

STARRETT GROUND FLAT STOCK

hold defense contracts and need subcontractors to help them speed up deliveries. These are its objectives:

1. To establish a chain of conveniently-located offices throughout the Nation where a contractor or potential contractor can receive all the information he could get from a trip to Washington.

2. To advise manufacturers how to get contracts for defense work they are equipped to do.

3. To encourage prime contractors to subcontract the greatest possible amount of their work.

4. To help small shop owners pool their facilities so that they can jointly participate in defense work which none of them is equipped to handle individually.

5. To see that any manufacturer who has suitable facilities and is otherwise qualified for defense work obtains the necessary financing.

There are 36 regional offices of the Defense Contract Service—one in each of the 12 Federal Reserve Banks and their 24 branch banks. With only one exception, there is one within 250 miles of every industrialist in the United States.

These regional offices are headed by production-minded business men. Their staffs include technical men competent to advise on the use and adaptability of plant facilities for defense work. Senior officers of the Federal Reserve Banks and branch banks are available to advise on financial problems. Staff members are there to explain the provisions of Government contracts.

Five great professional engineering societies are cooperating with the Service. Through them, technical advisors are available to the regional offices for consultation on special engineering problems—civil, electrical, mining, mechanical, or chemical.

## Army and Navy Buying Lists

The Defense Contract Service offices do not take the place of Army and Navy procurement officers who have been maintained in the field for many years. On the contrary, they are there to help the armed services by sending more qualified bidders to them and seeing that their requirements are known to business men throughout the land.

Every regional office of the Defense Contract Service has lists of articles that the Army and Navy want to buy. Blueprints and, in some instances, samples of these items are on hand.

Many manufacturers have machines and skilled men to handle defense jobs, but do not know how to get about getting a contract. The Army and Navy would be glad to use their facilities if they knew about them; in many instances, would prime contractors.

Regional offices will help bring these groups together by expanding, correlating, and analyzing the valuable plant facility surveys which already have been made by various public and private organizations. The results of these surveys, plus information obtained from manufacturers who visit the regional offices, will provide a catalog of the productive facilities in every region of the country. By consulting this catalog, the Service will be able to direct Army and Navy purchasing officers to the plants they need, prime contractors to plants capable of handling subcontracts for them, and prospective subcontractors to prime contractors who have what they could do.

These catalogs of industrial facilities may also serve as the basis for organizing small manufacturers who, by pooling their limited facilities, can handle defense work.



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**MORRISON**  
*will not compromise*  
**WITH QUALITY**

Despite the enormous demands for Morrison Collets and Feed Fingers . . . every Morrison Collet and Feed Finger manufactured is of the same dependable quality which makes Morrison a recognized leader.

Morrison will produce many Collets and Feed Fingers to meet present requirements. But . . . Morrison will not sacrifice Quality for Production since Morrison Quality means more Production for you.

You can always rely upon Morrison Engineered Collets and Feed Fingers for your Automatic Screw Machines, Chucking Machines and Turret Lathes.

**MORRISON**  
means  
*Engineered*  
**COLLETS AND  
FEED FINGERS**

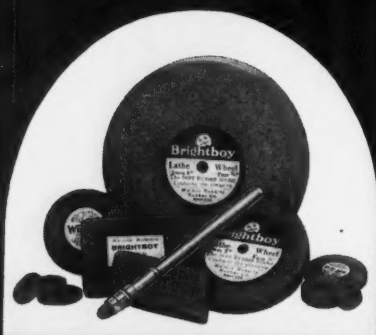
**HARDINGE BROTHERS, Inc.**  
ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



# Brightboy

*Is this AN ANSWER to  
your POLISHING and  
FINISHING PROBLEMS*



# Brightboy

*The Binder is SOFT RUBBER  
It CUSHIONS the Abrasive*

Made in DISCS, WHEELS  
and TABLETS

for FINISHING, PRE-FINISHING  
POLISHING and PRE-POLISHING  
METALS

# Brightboy

Leaves a bright, smooth  
polished surface

Write for Samples

WELDON ROBERTS RUBBER CO.  
Newark, New Jersey, U. S. A.

## Who Has Contracts Now

Lists of defense contracts already let are maintained at each regional office. These lists are brought up to date daily by dispatches from Washington. They enable the Service to tell potential subcontractors which firms have work in which they might share.

The Service also maintains at its regional offices a list of regular bidders for defense orders. This enables potential subcontractors to approach prospective prime contractors and figure on part of their work before they submit their bids.

The Office of Production Management believes that the spreading of defense work as widely as possible among existing plants is the best possible way to speed up immediate deliveries and to increase total production. Furthermore, it believes this is the best way in which greater concentrations of industry, complicating the problem of economic readjustment when the emergency ends, may be held to a minimum.

Manufacturers should provide essential information when they write or go to a Defense Contract Service office. They should send or take with them photographs of the interiors of their shops, taken from several angles, and pictures or descriptions of products they are now making or have made in the past. In addition, they should be prepared to give the answers to as many as possible of these questions:

How many employees do you have?

How many people could you employ on a one-shift basis, a two-shift basis, or a three-shift basis?

How many shifts are now working in your plant, and what is the length of each shift?

How many shifts can you work

Now

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June, 1941



# HEAT-FAG

works under Cover

## .. Like An Enemy Agent In Your Plant!

**SPREADING** discomfort — sapping vitality — slowing up production. Heat-Fag does its work quietly — unseen — *whenever men sweat*. For, sweating robs the body of its normal salt balance — and, doctors tell us that lowered efficiency, fatigue, discomfort follow — even sickness or cramps in extreme cases.

The defense against Heat-Fag is simple and inexpensive. Morton's salt tablets at every drinking fountain provide an easy way for workers to replace this salt loss . . . avoid the letdown and loss due to Heat-Fag.



### Place Morton Dispensers At All Drinking Fountains

Morton's modern dispensers deliver salt tablets, one at a time, quickly, cleanly, and without crushing or waste. Sanitary, easily filled — durable and dependable.

Morton's salt tablets contain the most highly refined salt, pressed into convenient tablet form, easy to take with a drink of water. They dissolve in less than 40 seconds after swallowing.

Order direct from this ad, or from your distributor.

**MORTON SALT COMPANY**  
CHICAGO, ILLINOIS

#### DISPENSERS

500 Tablet size - - \$3.25

1000 Tablet size - - \$4.00

#### TABLETS — Case of 9000

10 grain Salt Tablets, \$2.60

Combination Salt-Dextrose

Tablets, per case - - \$3.15



**FREE..**  
write on your firm letterhead for a pocket size sample tube of MORTON'S SALT TABLETS, and new folder, "Heat-Fag and Salt Tablets."

with the labor supply available in your community?

Do you have a design and development department?

List each of your machines, by size, type, manufacturer's name, manufacturer's serial number, the year in which the machine was built, and the tolerances to which it will work.

How many machine-hours do you have idle per week, over and above present commitments? (This information should be broken down by types of machines.)

Is your power source adequate?

What are your shipping facilities?

Who are some of your regular customers?

Have you ever had a defense order and, if so, for what?

Have you ever been a subcontractor, and if so, for whom?

Have you ever subcontracted any of your work and, if so, to whom?

When necessary to find plants for

specific purposes, the Defense Contract Service will send skilled production men, experienced in machine shops and manufacturing establishments, to inspect factories and consult with their owners. The Service is decentralized to put the Office of Production Management in closer touch with the productive facilities of the Nation. But an organization is maintained at Washington to supervise and coordinate the entire program.

Federal Reserve Banks and branch banks, where regional offices of the Defense Contract Service may be found, are located as follows:

Atlanta, Ga., 104 Marietta St.

Baltimore, Md., Lexington and Calvert Sts.

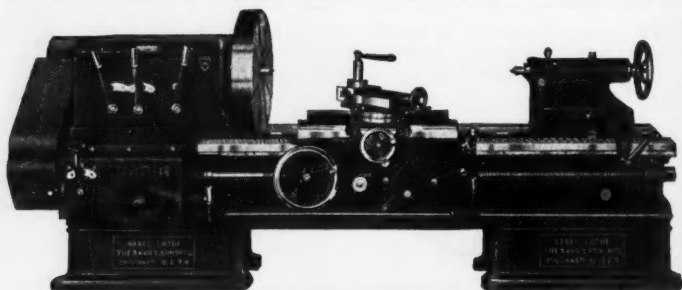
Birmingham, Ala., 18th St. and 5th Ave. N.

Boston, Mass., 30 Pearl St.

Buffalo, N. Y., 270-276 Main St.

Charlotte, N. C., 110 S. Tryon St.

Chicago, Ill., 230 South LaSalle St.



## 24" HEAVY DUTY GEARED HEAD LATHE

"NEBEL" Lathes made in sizes 16" to 36" swing, any length bed, for heavy duty work. Headstocks completely equipped with Timken Bearings. Can also be furnished in cone head belt driven type.

Also a full line of Removable Block Gap Lathes 16/25" to 26/40" swing and Extension Bed Gap Lathes 20/40" and 28/50" swing.

WRITE FOR DETAILED INFORMATION

**THE NEBEL MACHINE TOOL CO., CINCINNATI, OHIO**

# "HALLOWELL"

## STEEL SHOP EQUIPMENT

Plan the shop for the equipment, or fit the equipment to the shop. . . . Dense plants, new and old, find in the "Hallowell" lifetime line of standardized steel shop equipment, units that fit perfectly the production layout and the job — at costs generally far below that of building ordinary wooden equipment!

For the fastest way to take your plant out of construction and into production write — STANDARD PRESSED STEEL CO., Box 556, Jenkintown, Pa.

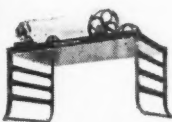


Fig. 754  
Pat. App. For

ALL TYPES OF TRUCKS OF

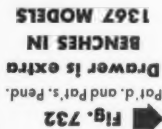
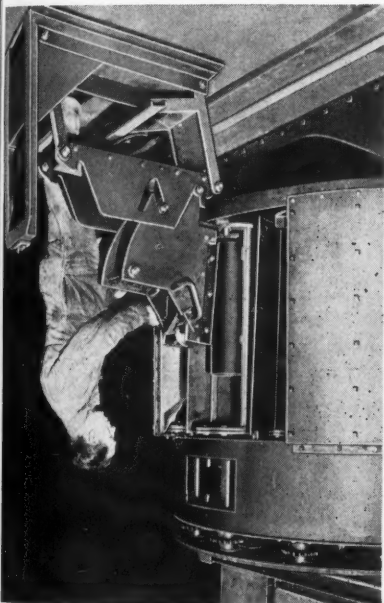


Fig. 732  
Pat'd. and Pat's. Pend.  
Drawer is extra  
BENCHES IN  
1367 MODELS



Benches • Stools • Trucks  
Tool Stands • Hangers and Collars



tion of auxiliary equipment to clean the outside of the shell in cases where manufacturers wanted to eliminate the exterior scale in order to save expensive tools. The new shell-cleaning equipment cleans the interior of the shells by air pressure, using air blast nozzles because

Loading Device in Elevated Position as Shell Is Placed in or Removed from Hanger

of the small opening in the end of the shell. However, the cabinet is designed so that an airless Wheelabrator unit can be added as auxiliary equipment for cleaning the exterior of the shell. The new design is said to reduce by one-half the amount of compressed air previously required for a given production. In one plant where this machine has recently been installed, it is cleaning 5,000 shells of 75 mm. size in 20 hours or 250 shells per hour. Two 5/16-in. nozzles are used with a total requirement of compressed air of 290 to 420 cu. ft. per minute. In another plant where a similar





**THIN WALL-THICK BLANK-**  
**8,500,000 PIECES**  
 THAT'S THE STORY OF THE **CROCAR** DIE  
 AND **RED CUT SUPERIOR** PUNCH  
 ON THIS INTERESTING JOB...



Material blanked—half-hard cold rolled strip, .062" thick.

Wall thickness of punch—.057".

Number of blanks between grinds—250,000.

Metal removed at each grind—.003" to .004"

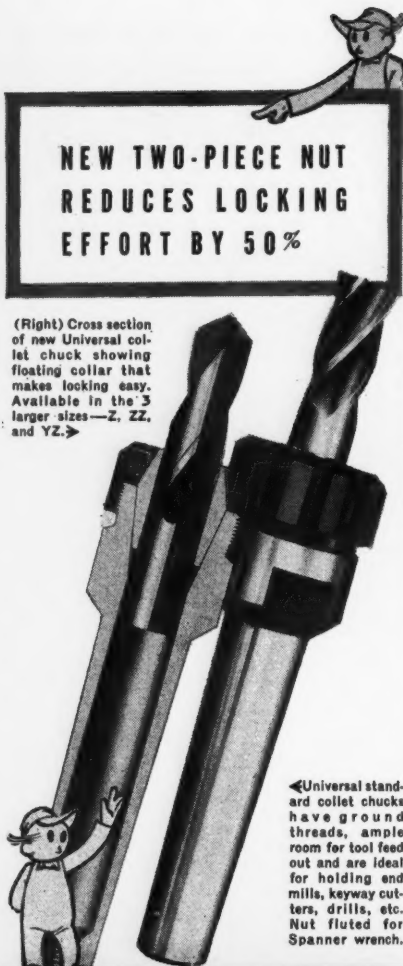
—Langston Mfg. Co., Chicago, Ill.

**Vanadium-Alloys STEEL CO.**  
 LATROBE, PA.



**NEW TWO-PIECE NUT  
REDUCES LOCKING  
EFFORT BY 50%**

(Right) Cross section of new Universal collet chuck showing floating collar that makes locking easy. Available in the 3 larger sizes—Z, ZZ, and YZ.→



←Universal standard collet chucks have ground threads, ample room for tool feed out and are ideal for holding end mills, keyway cutters, drills, etc. Nut fluted for Spanner wrench.

**UNIVERSAL**  
Engineering Company  
Frankenmuth, Mich.

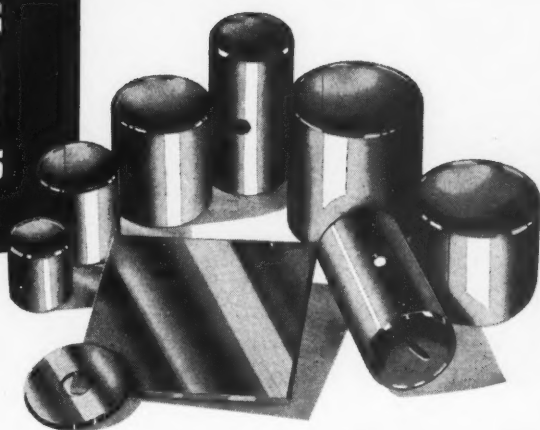
Cincinnati, Ohio, 4th and Race Sts.  
Cleveland, Ohio, East 6th St. and Superior Ave.  
Dallas, Texas, Wood and Akard Sts.  
Denver, Colo., 17th and Arapahoe Sts.  
Detroit, Mich., 160 Fort St. West.  
El Paso, Texas, 351 Myrtle Ave.  
Helena, Mont., Park and Edwards Sts.  
Houston, Tex., Texas Ave. and Caroline St.  
Jacksonville, Fla., Church and Hogan Sts.  
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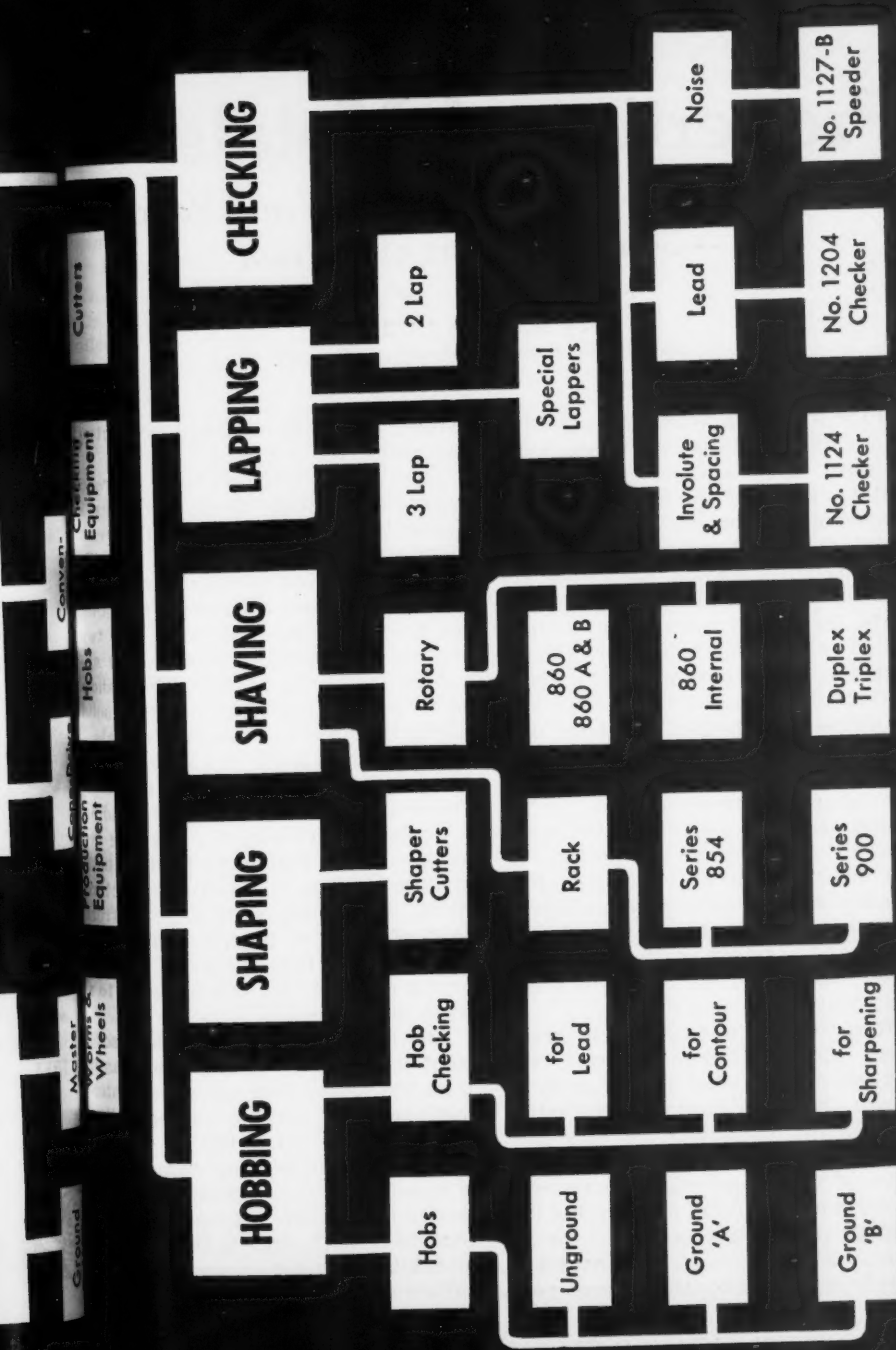
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# Properties of Metals, III

## The Equilibrium Diagram—Phases and Reactions —Solid Solutions of Carbon

By AUSTEN J. SMITH

Research Metallurgist, Lunkenheimer Company

IN the preceding article were pointed out the relationships which exist in most alloy systems when liquid metal is frozen in the mold under conditions of equilibrium. Little was said about the relationships which exist under conditions where the metals are not entirely soluble in the liquid state, for few systems are important which exhibit this behaviour, and on attaining a familiarity with the equilibrium diagram little difficulty will be found in interpreting those diagrams where such conditions appear.

It may appear to the reader that the material presented thus far is overly technical and of limited practical value, if any, in the handling of the industrial alloys. In explanation it may be said that a large number of the alloys in use today may be altered by heat-treatment, and it is upon these reactions and changes of phase that heat-treatments depend.

It must be admitted that in many cases the equilibrium diagram will not tell exactly what can be done to secure the most desirable properties in an alloy, but it will tell very precisely what cannot be done. Knowledge of the phase relationships may thus aid materially in interpreting the heat-treatments recommended for an alloy, and may be of very considerable help when a heat-treatment goes

wrong in finding out and correcting the causes of failure.

One very important type of reaction on freezing which occupies a transition position between the reactions which are concerned principally with liquid alloys and those which are wholly concerned with solids is known as the **peritectic** reaction. If two metals are wholly soluble in one another in the liquid state but show only partial solubility in the solid state, the atoms of the two metals—in certain systems—may dissolve in one another in the solid state at intermediate concentrations, providing a crystal lattice structure can be developed which will accommodate both types of atoms. This lattice structure must, of course, be different from that of the two primary solid solutions, for in these solutions each alloying element can dissolve only to a fixed limit.

For example, if the primary solid solution is face-centered cubic, as it is in the copper base alloys, an intermediate phase may be formed with a body-centered cubic lattice containing more of the alloying element than is possible for the face-centered cubic lattice to dissolve. Many of the systems in which copper is the base metal exhibit this behaviour. The iron-carbon alloys also react peritectically



on freezing to form the important constituent "austenite."

The new intermediate phase may be formed on freezing by interaction between the frozen primary solid solution and the liquid solution with which it is in equilibrium.\* This is known as a **peritectic reaction**. In Fig. 1 this type of reaction is schematically shown. The **alpha** solid solution of composition A reacts at the **peritectic temperature** with liquid solution of composition B to form solid solution **beta** of composition C with falling temperature. Below the peritectic temperature the solubility range of beta usually widens out as the temperature is lowered, though not invariably, since in certain systems a sharply defined chemical compound is formed with practically no solubility range.

There is no case among the common alloys in which the peritectic reaction is the only reaction occurring in the entire system but the silver-platinum alloys have a diagram very similar to Fig. 1, the phase formed peritectically being the silver-rich phase, the first formed primary phase being the platinum-rich. It is, of course, not necessary that the peritectic phase extend over the remainder of the diagram, for at concentrations beyond the solubility limit the phase might very well be the product of a eutectic reaction.

With description of the case where a new phase is formed with falling temperatures, we now turn to the general case. Reactions which take place in binary systems are all represented on the diagram by horizontal

lines. The two phases whose compositions are indicated by the ends of a line react to form a new phase with either rising or falling temperature. The reasons for this will not be discussed here since they are not necessary to our purpose, but they may be

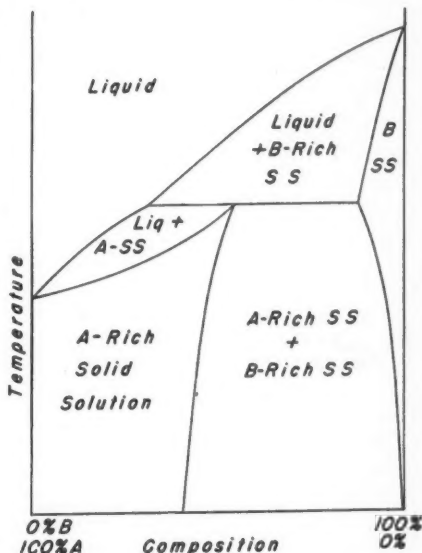


Fig. 1—Equilibrium Diagram Showing Peritectic Reaction as in Platinum-Silver Alloys

found in most text-books on physical metallurgy.

In the general statement, it is immaterial whether the phase are solid or liquid (or gas, although we are not concerned with the gas phase here). Reactions may take place with rising or falling temperatures, and two possibilities of reaction exist:

1. A phase decomposes with falling temperature into two other phases, shown diagrammatically in Fig. 2, and

2. Two phases react with falling temperature to form a new phase of intermediate composition, shown dia-

(\*Note—When a phase appears or disappears it is customary to speak of the operation as a reaction; thus, eutectic reaction. A phase may be formed or decomposed with change of temperature but in each case the direction in which the temperature is changing must be stated.)

grammatically in Fig. 3.

Compare Fig. 2 with Fig. 1 of the previous article, the copper-silver system, and Fig. 3 with Fig. 1 of the

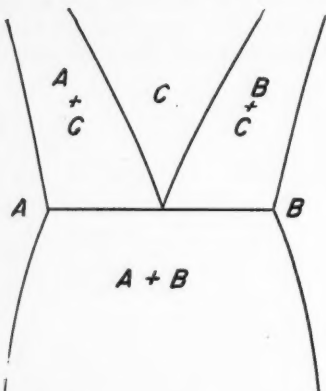


Fig. 2—A Phase Decomposes with Falling Temperature into Two Other Phases

present article, which may be considered the silver-platinum system. The representation will be readily apparent; the letters indicate the fields of the homogeneous phases, the other fields being heterogeneous or mixtures of phases. For each case there are six possible types of reaction. They are for Case I.

1. Liquid C  $\rightarrow$  Liquid A + Liquid B
2. Liquid C  $\rightarrow$  Liquid A + Solid B  
monotectic
3. Liquid C  $\rightarrow$  Solid A + Solid B  
eutectic
4. Solid C  $\rightarrow$  Liquid A + Liquid B
5. Solid C  $\rightarrow$  Liquid A + Solid B
6. Solid C  $\rightarrow$  Solid A + Solid B  
eutectoid

The names following Types 2, 3 and 6 are the names by which these reactions are usually known. Types 1 and 4 are not known in alloy systems; Type 5 is rare but is found in at least one common alloy system—copper-tin—in this case solid gamma decom-

posing to form liquid and solid epsilon. The other three types are common, the monotectic being often found in systems with incomplete liquid solubility, and the eutectoid being the most important commercially of all of the reactions since it is the one found in the iron-carbon alloys or steels and upon which we depend for heat-treatment. This will be dealt with in detail later.

Six reactions also may be written for Case II.

1. Liquid A + Liquid B  $\rightarrow$  Liquid C
2. Liquid A + Solid B  $\rightarrow$  Liquid C
3. Solid A + Solid B  $\rightarrow$  Liquid C
4. Liquid A + Liquid B  $\rightarrow$  Solid C  
syntectic
5. Liquid A + Solid B  $\rightarrow$  Solid C  
peritectic
6. Solid A + Solid B  $\rightarrow$  Solid C  
metatectic

Types 1 and 3 are not known and Type 2 is not found in alloy systems. Type 4, like Type 2 for Case I, is

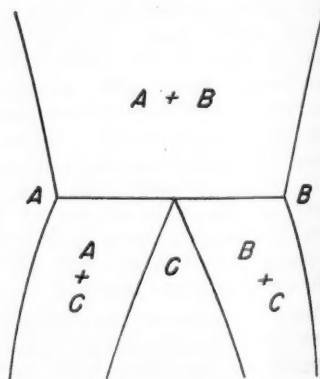


Fig. 3—Two Phases React with Falling Temperature to Form a New Phase of Intermediate Composition

found in systems showing incomplete liquid solubility, Type 5 is a very common freezing process, and Type 6 is a common type occurring in the solid state.



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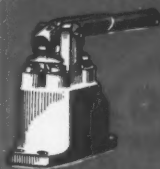


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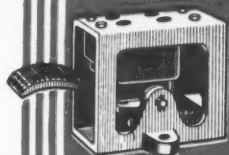
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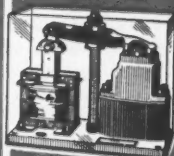
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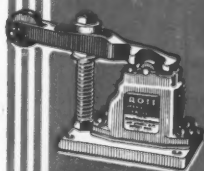
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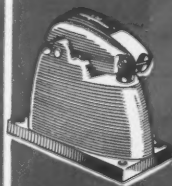
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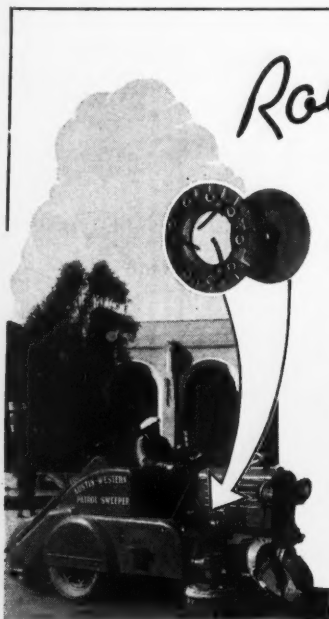
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With the listing of these twelve types of reactions, all of the possible behaviours are described which are possible in any mixture of two metals in the liquid and solid states, and, as we have seen, five of them are thrown out as either impossible or not of interest in alloy systems, another one is very rare, leaving at most seven, and practically six types of behaviour that may be of interest.

Two of these seven are not often encountered in commercial alloys, the two involving incomplete liquid solubility, and while certain examples are important—such as addition of lead to copper alloys for free machining purposes—they are of interest chiefly to the producer of ingots or castings and have little importance when dealing with the solid shapes or castings as they would arrive in the shop. Thus we have left four, or at most five, reactions which may appear in the various industrial alloys.

With the general statements of the conditions of phase equilibria in alloy systems, it may be well to describe some of the properties of the different phases before discussing a specific case. The terminal solid solutions are normally expected to show moderate to low strength and hardness, and moderate to high ductility. The crystal symmetry will be at least as high as the pure metals on which the solid solution is based, and it is on this high symmetry that the physical properties depend.

The metals showing a body-centered cubic structure are usually tough and of high strength as compared with metals with a face-centered cubic structure which are usually soft and ductile and of low strength. For example, compare the properties of iron or tungsten with those of copper or gold. The hexagonal metals including zinc and magnesium have moderate strength but

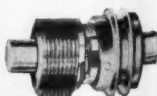


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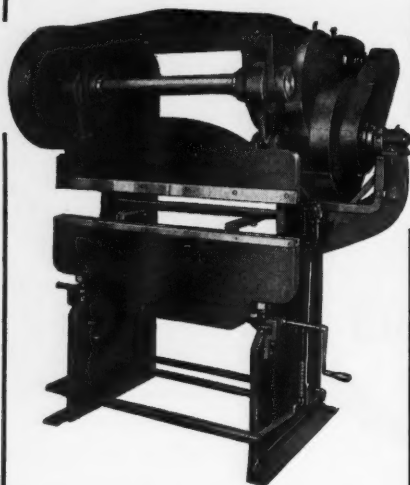


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usually low ductility because of their less regular crystal structure.

The statements that hold for the pure metals are likewise true for their primary alloys, but the trend with additional alloy content is for the strength and hardness to increase and for the ductility to drop. Much higher strength is found in cartridge or hardware brass containing thirty or more per cent zinc than in pure copper, although at the expense of some of the ductility. Resistance to impact also decreases with increasing alloy content.

The intermediate phases in alloy systems are of less regular crystal structure than the primary phases, and the properties change in accordance with this regularity or the loss of it. For example, the beta phase in the brasses is body-centered cubic and shows higher hardness and strength and much less ductility than the alpha brasses. As the intermediate phases become even less regular, as in gamma brass which is quite irregular, hardness runs even higher, but now the strength drops off and the ductility approaches the vanishing point, the alloys being exceedingly brittle. This is, in general, true for all highly irregular alloy phases which are found as intermediate phases in the metal systems.

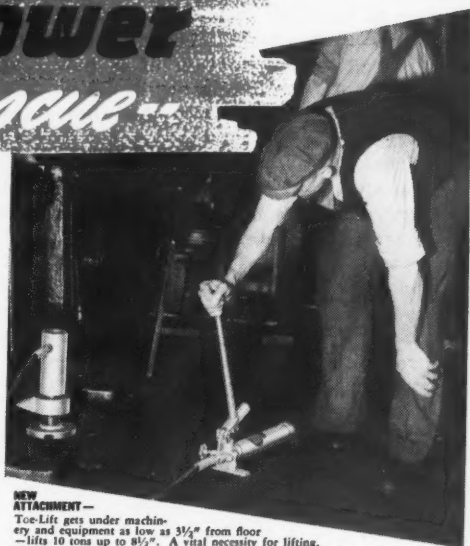
Mixture of phases show mean properties that may be calculated for the mixture, but *only* if there is uniform and non-selective distribution of the constituents. Unfortunately, reaction always commences at points of highest internal stress, and these points are found principally at grain boundaries where there is an unbalancing of the inter-atomic forces.

As a result, when the second phase is formed it will always form first at the grain boundaries, and this envelopment of the grains will cause brittleness and loss of strength even though the enveloping phase may



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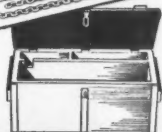
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show good properties by itself. The reason is that the unbalanced forces at the grain boundaries become more unbalanced with rejection of a new phase and the new phase will be so thin and so complete as to show only its own properties at best—and less than these—because of the high distortion that will exist.

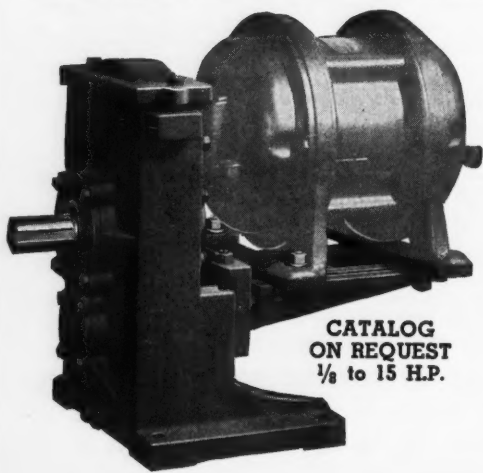
A second phase in the grain boundaries is a bad state of affairs and is to be very carefully guarded against. If the alloy is to be used as a two-phased alloy, careful heat-treatment or mechanical working is necessary to secure the proper distribution of the secondary phase. An example of this may be given in the case of ingot iron. The amount of residual carbon is very small in the ordinary analysis but even this very small amount of remaining carbon can at times be rejected in the grain boundaries, seriously impairing the ductility and rendering it unsuitable for many pur-

poses. In many cases the second phase is highly desirable, as is the case when good wearing properties are desirable, but great care is needed to secure a proper distribution of the second phase. The bearing metals are examples of this.

Most of the intermediate phases in alloy systems are of little importance commercially, but in small amounts they may perform very useful functions in securing high strength alloys. If they are not intentionally a part of the alloy, they may appear inadvertently as a consequence of faulty composition or heat treatment.

A frequent example appears in the burning of alloys. In burning, an alloy is heated just over the line of initial melting (final freezing) and local melting will take place at the grain boundaries as well as at any other discontinuities such as at an inclusion. This local melting will so alter the composition that a second phase

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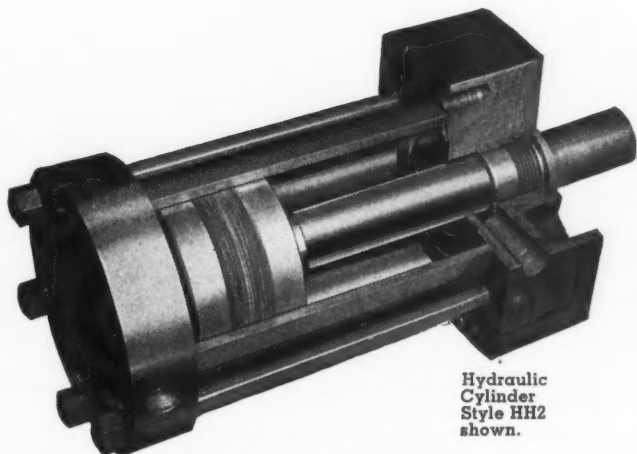
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may appear in an alloy normally completely within the solid solution field, and even protracted soaking at high

tail. The most interesting diagram to the average man dealing with metals and metal products is in the iron-carbon diagram.

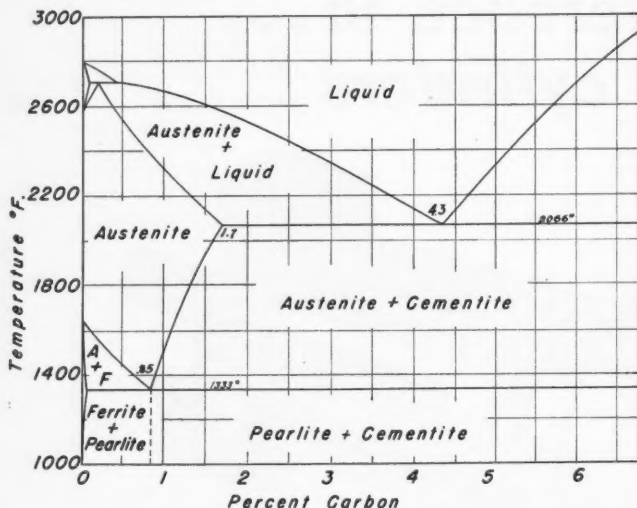


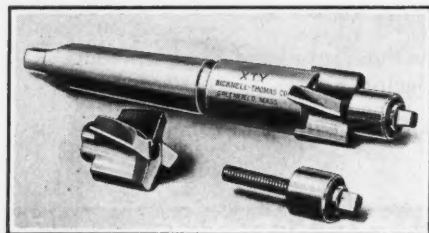
Fig. 4—The Iron-Carbon Diagram

temperatures will seldom bring about complete reabsorption of the second phase; consequently a part to be highly stressed would be better thrown back into the melting furnace once it has been overheated.

With this enumeration of some of the qualities to be expected in an alloy from the point of view of its phase diagram, we may go to a specific diagram and study it in more de-

tail. The most interesting diagram to the average man dealing with metals and metal products is in the iron-carbon diagram. This diagram is shown in Fig. 4. Three solid solution phases normally appear in this diagram and at the right margin a fourth type of phase is given about which little has been said. This fourth phase is the compound of iron and carbon,  $\text{Fe}_3\text{C}$ , more commonly known as cementite.

There is no difference between a compound and any other phase, so far as the phase diagram is concerned. The compound merely represents a solid solution phase which may have a rather wide solubility range but more often practically none at all so that the composition may be described by a chemical formula. Such is the case with the intermediate solid solution of carbon in iron, no range of solubility being found. (This will be discussed later.)



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June, 1941

MODERN MACHINE SHOP

145

The cementite composition defines the extreme limit of the useful alloys of carbon and iron, and the diagram beyond this composition has never been worked out.

As pointed out in the first article of this series (April, 1941), iron shows two transformations in cooling from the first frozen metal down to room temperature. These transformations are reflected across the whole phase diagram since the different phases have different solubility ranges for carbon. The solubility of carbon in delta iron and in alpha iron is slight, amounting to a maximum of 0.08 per cent in delta and 0.35 per cent in alpha. Gamma iron, on the other hand, can accommodate 1.7 per cent, and the properties of gamma become very much different from those of alpha. Little need be said about the delta phase since it exists only at very high temperatures, far above the normal heat-treating range, and is

not encountered commercially.

The solid solution of carbon in face-centered cubic **gamma** iron is called **austenite** and is formed peritectically by reaction of the **delta** solid solution with liquid at 2719 deg. F. At a composition of 4.3 per cent carbon the liquid melts eutectically at 2066 deg. F., the two phases of the resulting product being cementite (of 6.67 per cent carbon) and austenite (in which 1.7 per cent carbon is dissolved). The temperature of transformation of gamma to alpha iron, taking place at 1670 deg. F. in pure iron, is depressed by addition of carbon up to a content of 0.8 per cent carbon, where at a temperature of 1333 deg. F. the austenite phase decomposes eutectoidally into the solid solution of carbon in alpha iron and cementite. The alpha solid solution is called **ferrite**, and at the eutectoid temperature a maximum of 0.035 per cent carbon may dissolve, the solubility diminishing

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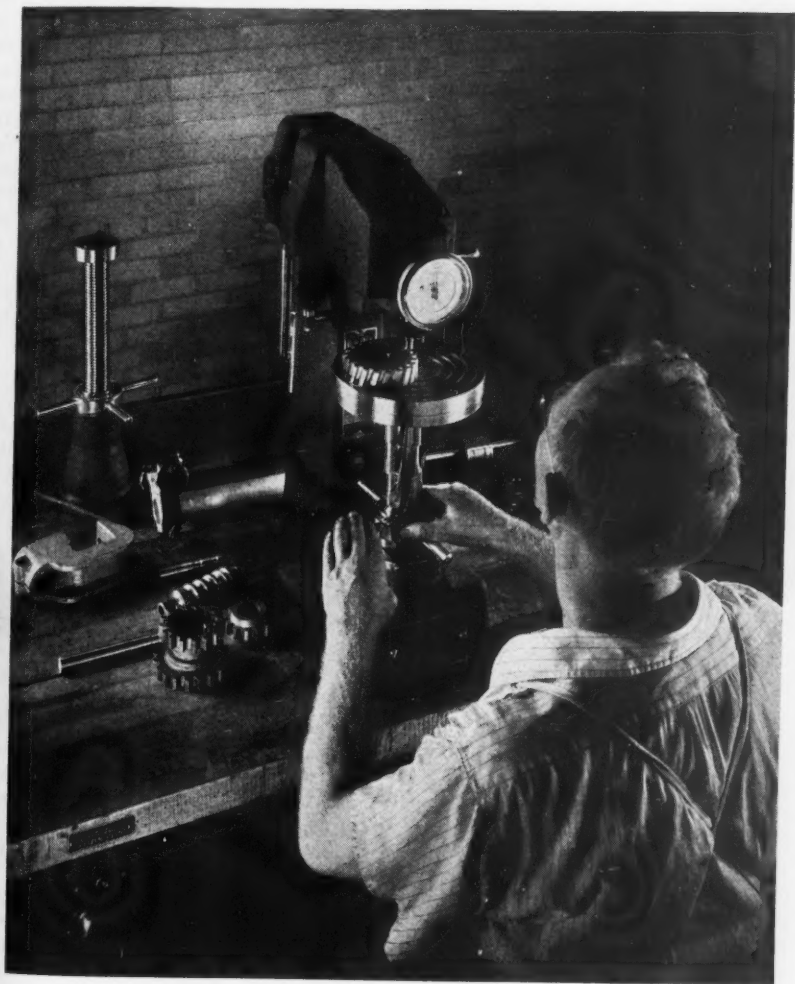
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MODERN MACHINE SHOP 147

June, 1941

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with falling temperature to less than 0.006 per cent at room temperature.

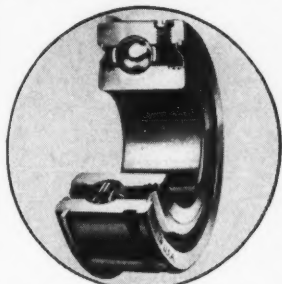
When cooled in air from the austenite field, the eutectoid of ferrite plus cementite takes on a characteristic plate-like structure and the light interference from these plates gives the appearance of mother-of-pearl, hence the name, **pearlite**. All alloys of less carbon than 0.8 per cent will be mixtures of ferrite and pearlite, and those of higher carbon content will be mixtures of pearlite and cementite. The pearlite eutectoid almost takes on the attributes of a constituent because of its definite characteristics in, say, a normalized steel, even though only a mechanical mixture of two other phases.

All of our statements thus far concerning phase relationships in alloy systems have been restricted to equilibrium conditions. However, we overstep our restriction when we speak of **cementite**. Cementite, the iron carbide, is not an equilibrium phase as it is not approachable from all directions. The actual stable phase is graphite—a form of pure carbon.

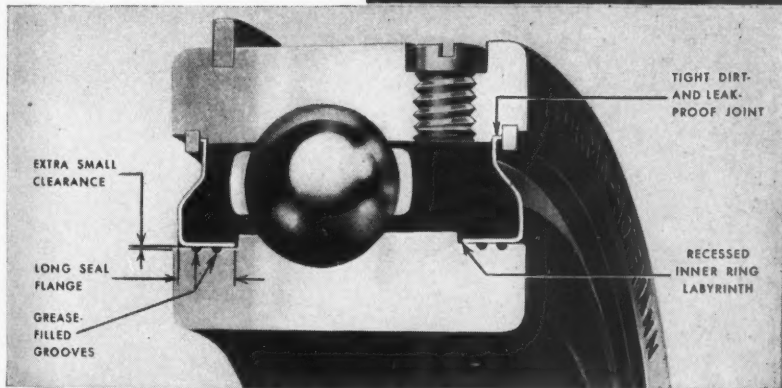
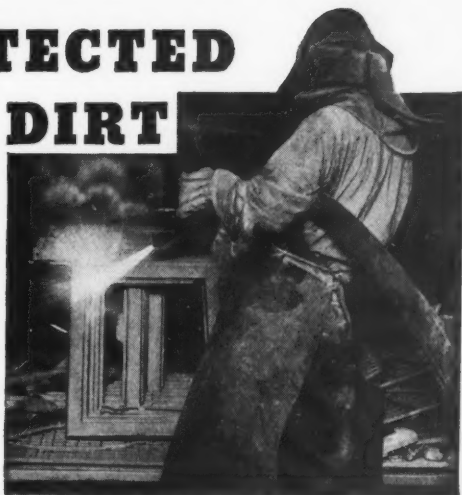
Cementite shows a fair degree of stability at low carbon concentrations, but at higher concentrations it may be broken down with prolonged heating, and at yet higher concentrations, such as near the eutectic composition, it cannot be produced under any circumstances. Pure cementite cannot be prepared by any of the means we have at our disposal and so it is impossible to study the properties of this compound. Cementite stability is increased by the presence of alloying elements such as manganese, and in commercial steels sufficient manganese is usually present to prevent graphitization.

The graphitization of cementite that takes place with prolonged heating is made use of in the recently developed graphitic steels and in the older malleable iron. Cast iron nor-

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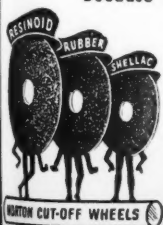
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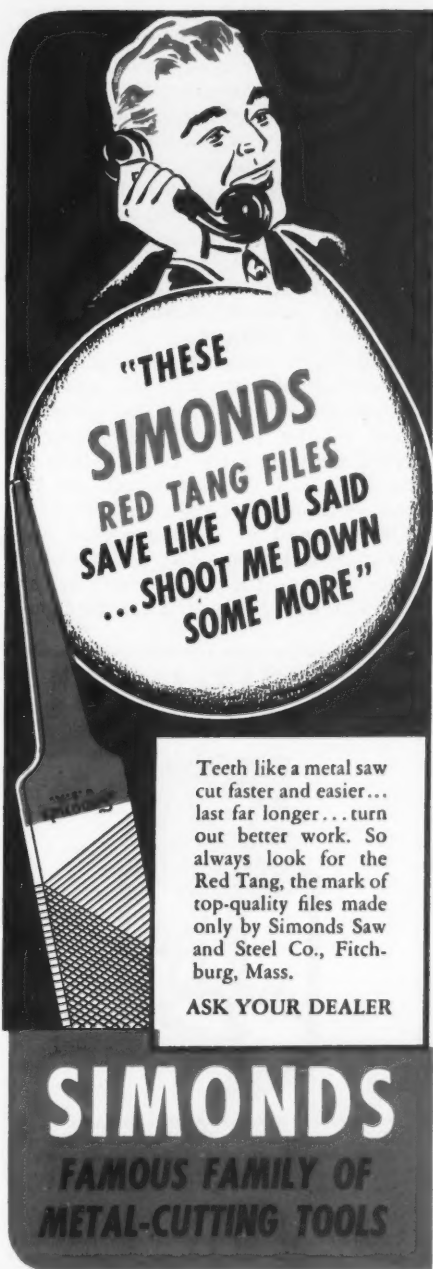


ally contains 3 per cent or more carbon, 3.5 per cent being a common analysis. In such irons cementite does not exist by itself; the carbon that is found free being of the graphitic form. However, in the present high strength irons cementite is found as part of the pearlite which makes up the matrix of these irons.

Cast iron is not a binary alloy of iron and carbon, but carries silicon, manganese and phosphorous as principal impurities carried over from the pig iron. These alloys have a pronounced effect on the structure of the iron, silicon especially being a pronounced graphitizing agent. Other elements are also added, either to promote or to retard graphitization, the cementite in the pearlite being the phase chiefly affected.

In any normal steel the different constituents possess the following properties: Ferrite has a tensile strength of about 40,000 p.s.i., around 40 per cent elongation, and a hardness of about 80 Brinell. This would represent fairly the properties of, say, pig iron, which has a very low carbon content. Pearlite has a tensile strength of around 115,000 p.s.i., an elongation of about 10 per cent, and a hardness of about 200 Brinell. These would be the properties of a normalized tool steel of about 0.80 carbon.

It is impossible to say what the tensile strength of cementite would be since it is impossible to prepare the pure compound. However, as it behaves in high carbon steels it is quite brittle and gives an elongation of effectively zero, with hardness in excess of 700 Brinell. In the normalized state; that is, in a state where the carbon is all in the pearlitic condition and free from cold-working, the strength can be fairly calculated by figuring the percentage of the constituents present. Thus a steel made up of half ferrite and half pearlite should have a strength near the mean of the



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tensile strength of the two constituents, or roughly 77,000 p.s.i. in a steel of 0.40 per cent carbon—which is approximately correct for a steel of this composition when in the pearlitic condition. As the tensile strength of cementite is probably quite low it follows that a fully pearlitic steel, that is, of 0.85 per cent carbon, should show the highest strength of all of the normalized steels. Note that the effects of heat-treatment are debarred from our considerations. These will be taken up later.

Additional alloying elements have the effect of altering the reaction temperatures and also the compositions of the phases. For example, nickel depresses the temperature of the eutectoid decomposition, or the gamma-alpha transformation temperature, and at certain nickel concentrations austenite is preserved at room temperature, some five to six per cent being required for this pur-

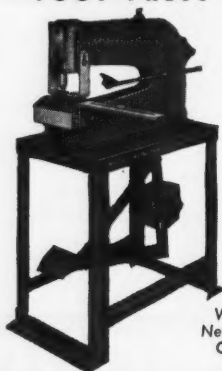
pose. On the other hand, chromium raises the transformation temperature. In alloys with more than 12 per cent chromium, austenite is not found at any temperature.

A suitable balance can be found between, say, the two elements, nickel and chromium, wherein the nickel may offset the effect of the chromium, permitting the steel to be preserved in the austenitic condition at room temperature. This is done in stainless steels of the type 18 chromium: 8 nickel. The desirable stainless properties of the chromium iron alloys are far greater in the austenitic condition than in the ferritic condition. It is rather difficult to produce austenitic chrome-irons, but by the addition of nickel this result is brought about.

In this article the equilibrium diagram has been discussed in its general form. Analogy of the diagram with a map may again be drawn to show that the diagram may be used by the non-technical reader without entering into a discussion as to why the systems behave as they do. The iron-carbon diagram has been taken as a specific example of the equilibrium diagram and the normal constituents found have been briefly described. Some of the effects of other alloying elements have been touched on. In metallurgical work non-equilibrium conditions are as important as equilibrium, and in the next article these non-equilibrium conditions will be discussed in considering the effects of heat-treatment.

(The fourth article of this series will be published in the July issue.)

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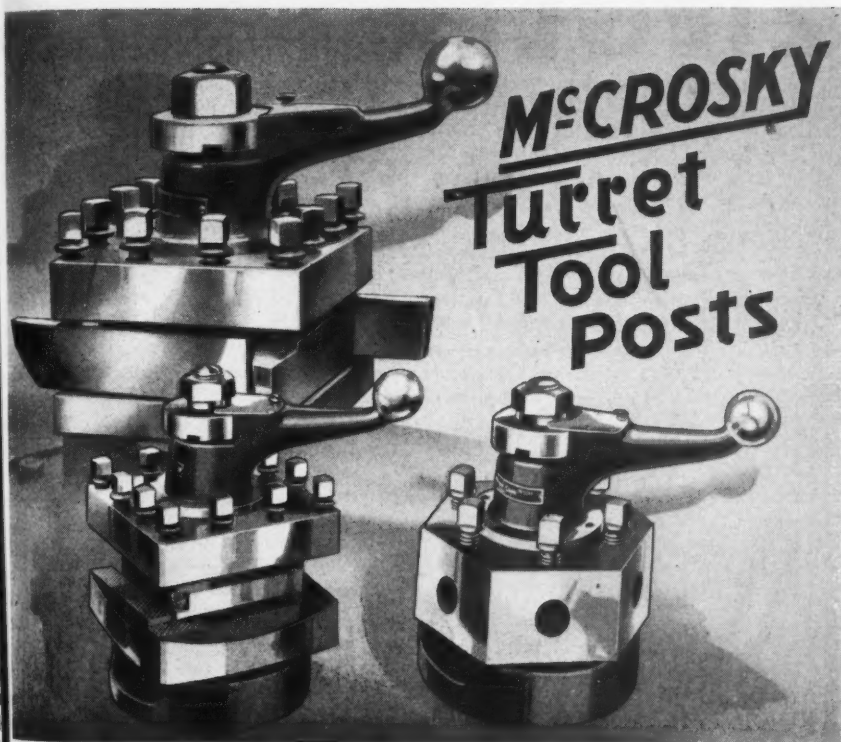
**Du Pont Carburizing Salt** for production of deep high-carbon cases on plain carbon and alloy carburizing steels is the subject of a four-page technical service bulletin now being issued by I. du Pont de Nemours & Co., Inc., Technical & Chemicals Department, Wilmington, Del. Copy free upon request.

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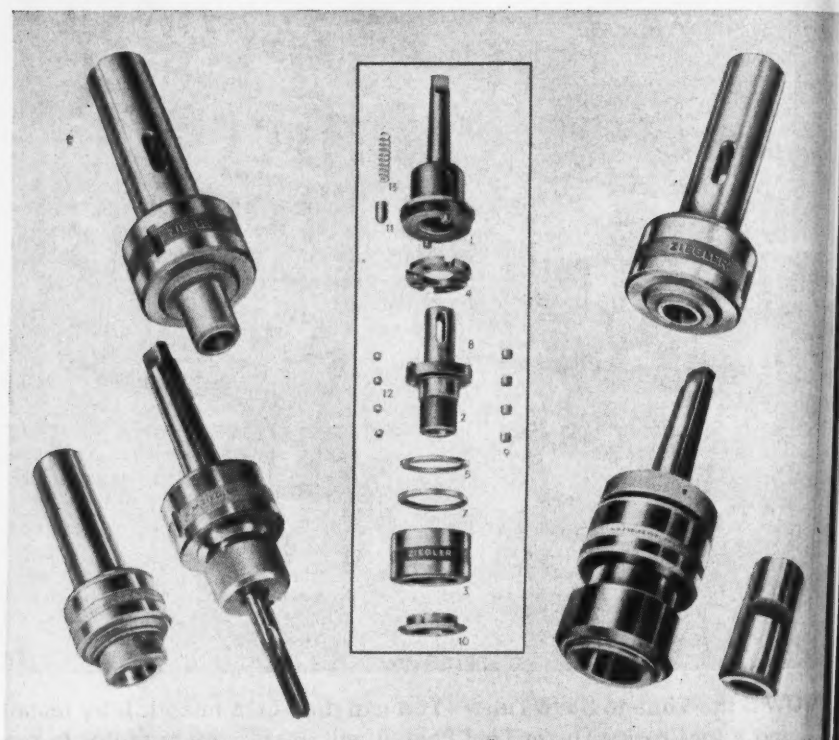
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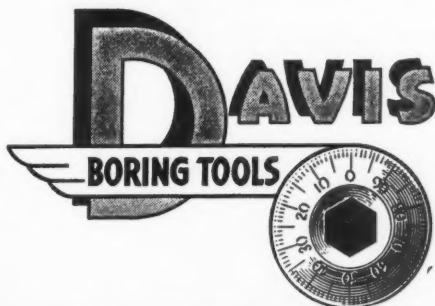
The reason is, of course, obvious. Defense orders had to have the right of way — and there was a multitude of them coming to us all at once and literally swamping our facilities.

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# IDEAS FROM READERS

## Hand Fixture for Small Clips

By CHAS. H. WILLEY

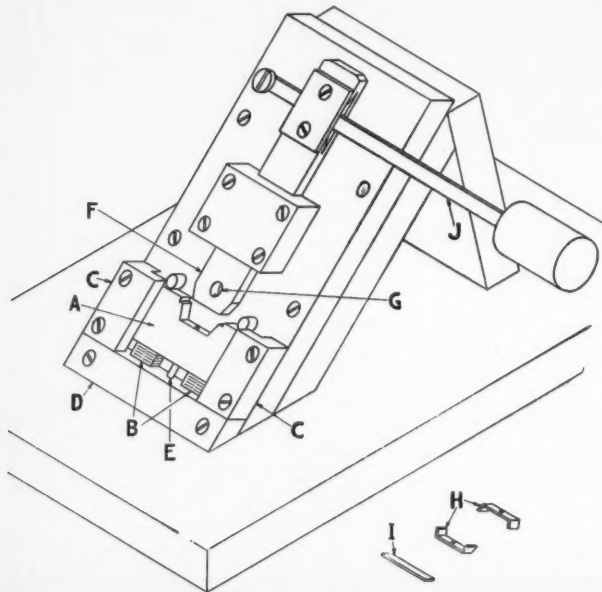
**T**HE drawing illustrates the design of a fixture for use in making small clips of the type shown at **H**. The clip is made from 1/64 in. thick x 1/4 in. wide semi-hard brass and is to be used as a glass retainer in a molded Bakelite case. The first operation

is making the clip consists of cutting the 1/4-in. wide stock from the coil in pieces 1/8 in. long, as shown at **I**. The next operation, which includes the piercing and bending of the part, is performed on the fixture shown in the illustration.

The fixture is mounted on an inclined wooden stand designed to permit the operator to readily locate the blank by simply dropping it into the lower moving die **A**. This die is supported by the rubber pieces **B** and moves in the guides **C**. A stationary punch, **E**, is located in the base **D** and passes through the center of die **A**.

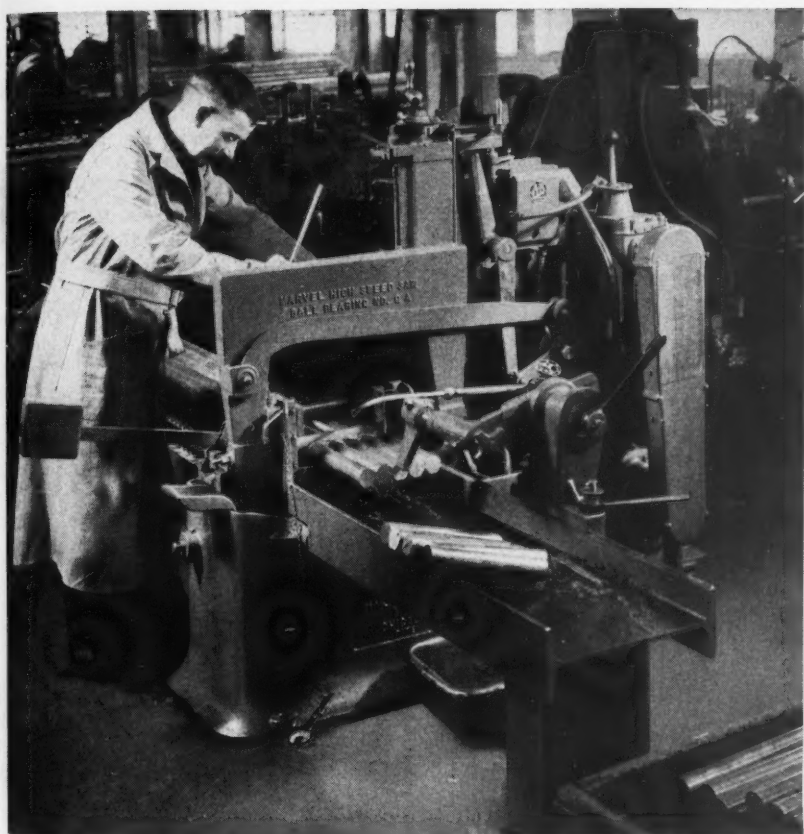
The end of the tool steel ram **F** is shaped for the forming of the clip and is drilled to receive the punch **E**. The ram nose is also provided with a slug clearance hole, **G**. The upper end of the ram has a curved slot for the operating lever **J**, at the end of which is a metal weighted handle that acts as a sort of hammer during

the forming of the clip and is drilled to receive the punch **E**. The ram nose is also provided with a slug clearance hole, **G**. The upper end of the ram has a curved slot for the operating lever **J**, at the end of which is a metal weighted handle that acts as a sort of hammer during



Drawing Showing Design of Fixture Used in Making Small Clips





**MARVEL 9A** (capacity 10" x 10") Cutting-off shafts at the Monarch Machine Tool Co.

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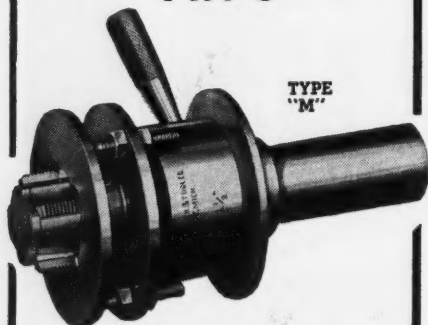
- When the Monarch Machine Tool Co., builders of Monarch Precision Lathes, needed another cutting-off machine, they chose a MARVEL 9A Production Saw . . . one of MARVEL'S new heavy-duty, all-ball-bearing sawing machines with automatic bar push up. These are the fastest saws built—will cut-off more pieces, floor-to-floor, from single or nested bars than can be cut-off by any other method.



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Chasers are rigidly supported  
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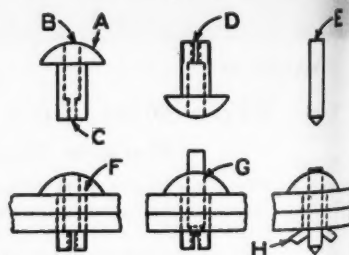
ing the piercing and forming operation.

In use, the part I is placed in the  
moving die A and the ram F is  
brought down onto the part by means  
of the operating lever J. As the ram  
strikes the work, the die A along with  
the workpiece is forced down onto the  
pieces of rubber B, thereby causing  
the stationary punch E to pierce  
through the part and enter into the  
hole drilled in the ram. At the same  
time, the nose of the ram bends the  
part to the desired shape. The slug  
formed during the piercing of the  
work is expelled through the hole G  
in the ram. Upon releasing the ram,  
the die A is forced up into position  
for the next part by the pieces of  
rubber B, at the same time stripping  
the workpiece from the punch.

## Self-Bucking Rivet

By A. H. WAYCHOFF

IN structural iron work it frequently  
becomes necessary to place a hold-  
ing rivet where it is impossible to  
reach it for "bucking" or setting the



Drawing of Self-Bucking Rivet

free end. The drawing illustrates  
very satisfactory method that can be  
employed when such an occasion  
arises.

A rivet A of the desired size is se-  
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the diameter of the rivet, is drilled  
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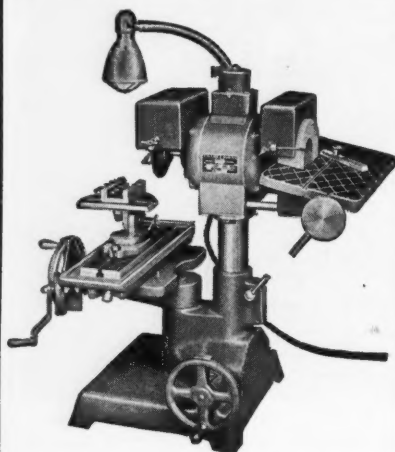
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depth equal to the thickness of the plates or sheets that are to be riveted. A smaller hole, C, is then drilled the rest of the way through the rivet. The end of the rivet is now split with a thin hacksaw blade so as to form two or four segments, according to the diameter of the rivet, as shown at D. A pin E is made of the same diameter as the hole C and the end of the pin is ground to form a point, as shown.

## CARBIDE TOOL GRINDER



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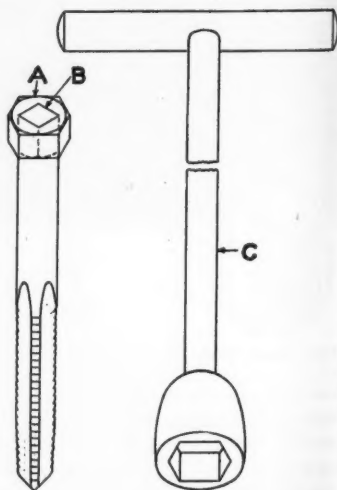
**K. O. LEE COMPANY**  
Aberdeen, South Dakota

The rivet is placed in the hole in the plates as shown at F, then the pin E is driven into the hole in the rivet as indicated at G. The pin drives easily, the hole being of the same diameter, until it comes to the smaller hole. Then continued driving on the pin spreads the segments open and against the inner wall of the plates as shown at H.

## Socket Wrench Adapter for Taps

By W. H. NOSTELL

**O**CCASIONALLY it becomes necessary to tap or re-tap a hole in a piece of work where the hole is in a place that is difficult to reach with a



Socket Wrench Adapted for Use with Tap  
(A) Hex Nut. (B) Square Head of Tap.  
(C) Socket Wrench

hand wrench. The drawing shows a simple method of adapting a long-handle socket wrench to fit the head of a tap.



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WITH THIS

# SPEEDY

# "TROUBLE SHOOTER"



**SNAP-ON  
MAINTENANCE  
SET No. 477Y**

Keep this set in a handy place . . . for with it you can handle most any emergency nut-turning problem with speed and efficiency that will save time and money. Hundreds of wrench combinations can be made from the selected tools comprising the set . . . 28 hexagon sockets covering the entire range from  $\frac{1}{4}$ " to  $1\frac{1}{2}$ ", ratchet, nut spinner, universal, sliding and extension bars . . . all mounted for ready accessibility in a sturdy steel case that carries easily and stands upright when open.

*Write for complete information about this set and over 2,000 other Snap-on tools.*



## Snap-on Tools

for Production, Service, Maintenance

**SNAP-ON TOOLS CORPORATION**

Dept. MMS-6

• Kenosha, Wisconsin

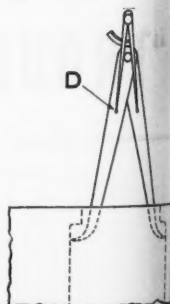
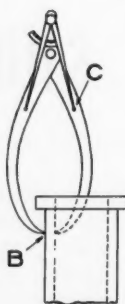
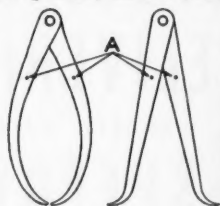
Make sure that such a wrench is available, then secure a nut of the size that fits the wrench and file the hole in the nut square so that it will be a drive fit on the end of the tap that is to be used. The nut, with the tap in place, is now placed in position in the socket of the wrench. If necessary, it can be wedged in to hold it in position while the wrench is being positioned in the work. With a variety of nuts filed in the manner de-

scribed, holes of different sizes can be tapped with the same wrench.

## Center Punch Mark on Legs of Calipers Improve Their Use in Measuring

By A. H. WAYCHOFF

BY marking each leg of an inside or outside calipers with a sharp point center punch, as shown at A in



Drawing Showing How Center Punch Marks on Legs of Inside and Outside Calipers Their Utility for Measuring Work Having Overhanging Ledges

the drawing herewith, the utility of such calipers can be greatly improved, especially when caliperizing work having overhanging ledges.

When using outside calipers, the caliper points are pressed together on the walls of the work below the overhanging ledge, as shown at B, and a pair of dividers is set so that its points will fit into each of the center

## SAW FILING and GRINDING MACHINERY and MACHINE TOOL FIXTURES



Industrial Engineering Co., Inc.

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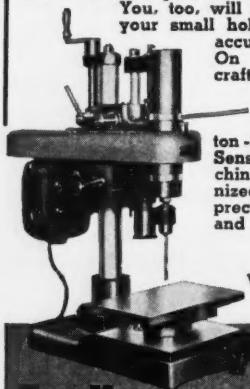
## MAXI-JR.-E.

### Super Sensitive Drilling Machine

Customers on sending in repeat orders tell us, "We want your machine—it's 'Tops'."

You, too, will find it "tops" on your small hole drilling where

accuracy is essential. On instrument, aircraft, Diesel, and any other type of precision drilling, the Hamilton-Muehlmann Super Sensitive Drilling Machines have a recognized superiority in precision, sensitivity, and economy.



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**THE HAMILTON TOOL CO.**  
MIL & HARVEY STS. HAMILTON, OHIO



For conservation of strategic and critical materials and for increased production in your shop standardize on

# MO-MAX

## MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL

It has demonstrated its broad field of usefulness and its superiority over 18% tungsten steel in cutting quality and machinability. MO-MAX offers long commercial experience, a large number of sources of supply, and broad development for all purposes. It is notably saving of tungsten and vanadium, which are largely imported. Its cost is low. To get more production and conserve strategic materials, shift to MO-MAX.

Leading steel companies have been licensed to produce their own brands of MO-MAX Steel under patents owned by The Cleveland Twist Drill Co.

MO-MAX tool bit boring  
holes in steel plate  
at a U. S. Navy Yard.

Illustration Showing How Drill Press Spindle can be Used to Lift Heavy Work so that Blocking can be placed under it

punch marks on the legs of the calipers in the manner shown at C. When the dividers have thus been set, they are locked and removed from the center punch marks. The calipers are then opened and removed from the work, after which they are closed until the points of the set dividers again fit into the center punch marks on the legs of the calipers. The setting of the calipers is now the same as it was prior to their removal from the work. A similar procedure can be followed when calipering work with overhanging ledges by means of inside calipers, as shown at D.

The punch used for marking the legs of the calipers should be sharp so as to make a fine indentation, thus making it possible to obtain accurate measurements without danger of the dividers points slipping out of the indentations.



## Eveready Work Hoist on Drill Press

By ARTHUR HAVENS

**T**HE task of lifting awkward parts or the ends of heavy pieces, such as locomotive side main rods, in order to position parallels or blocking under them often presents a problem to the drilling machine operator. By utilizing the power at hand such a



### THE NEW "C & J" 15" AND 16" LATHES

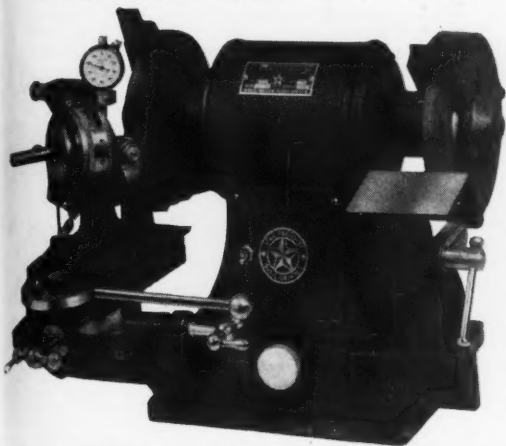
12 Speed Geared Head Motor Drive  
Timken Mounted Spindle  
Modern Design—liberal dimensions

*Write for Bulletin*

**THE CARROLL & JAMIESON MACHINE TOOL CO.**  
BATAVIA      OHIO, U. S. A.

# GRIND PERFECT POINTS ON DRILLS

Sizes No. 41 (.096) to  $\frac{5}{8}$ " (.625)



The STAR Precision Drill Grinder produces perfect points on standard twist drills — easily and quickly — without the use of attachments. It is equipped with a precision-made chuck adjustable for the entire range specified.

Lip angles 29 to 89 degrees are obtained by setting compound rest at required reading. Each lip is set for the grind by indicator reading, making it possible to obtain variable clearances behind cutting edges. Zero setting gives a 12 degree clearance behind edge.

Simple to operate — speedy in action.

*Write for folder.*

## Star Machine & Engineering Corp.

Division of Star Electric Motor Co.

BLOOMFIELD

NEW JERSEY



Drill is inserted in chuck-lip set to indicator. Cam handle is pulled releasing indicator slide automatically.



Drill point moves to wheel. Cam handle is pulled until forward motion stops. Then feed screws are adjusted until lip touches wheel.



Complete cam movement. Chuck tilts creating the cutting edge and clearance behind it.

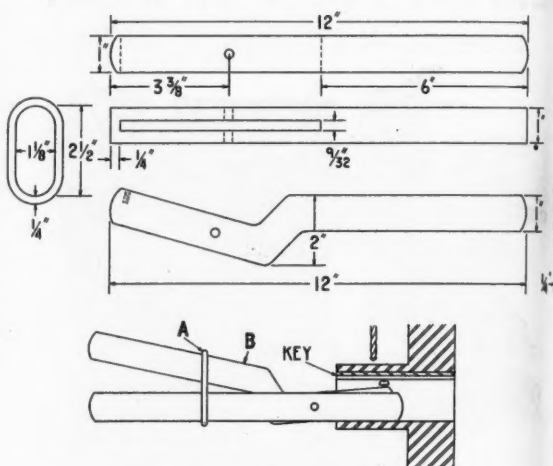


Chuck is rotated until other lip engages indicator finger and set to reading. Cam handle is pulled (ignoring feed screws).

problem can be solved without involving a great amount of labor.

Simply insert a short piece of steel into the drift pin slot in the drilling machine spindle, affix a light chain or cable to the work, and slip a loop of the chain over the steel piece in the drift pin slot. By revolving the feed handle by which the spindle is raised and lowered, the operator can raise the work to the required height, arrange his blocks or shims, and lower the work-piece back into position with the assistance of a helper.

firmly in place. To eliminate such condition, a tool consisting of the parts shown in the drawing can be made with which internal pressure



Drawing Showing Details and Application of Handy Key Clamp

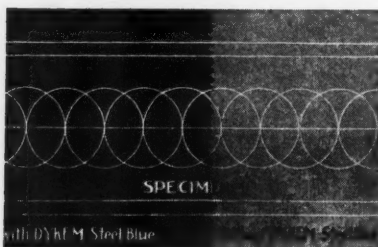
## Key Clamp of Handy Design

By ROGER C. DICKEY

**A**S practically every machinist knows, much time is consumed in clamping a key firmly in the keyway of a gear prior to drilling a hole through the keyway and key to receive a pin or screw which holds the key in position. Oftentimes, drills are broken because the key is not held

can be applied against the key, thus holding it firmly in position without the need for other clamps.

To use, the operator simply places the key in the keyway of the gear to be drilled, inserts one end of the tool in the bore of the gear as shown in the drawing, and slides the ring A back along the handles of the tool, thereby locking the nose of the clamp piece B firmly against the key. The



## DYKEM STEEL BLUE

**Stops Losses in Making Dies and Templates**

Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glazing. Increases efficiency and accuracy.

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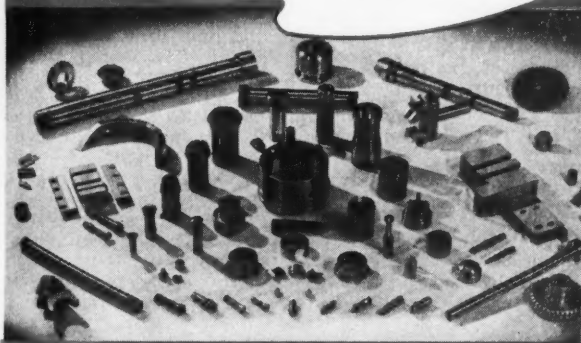
**THE DYKEM COMPANY**

2301 F. NORTH 11th ST.

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(In Canada: 3194 Dundas St., W., Toronto, Ont.)

# Everything FOR Every SCREW MACHINE



**T**HE Modern Collet and Machine Company is the only concern of its kind in the world.

Here any screw machine repair part or tool is available . . . or, if a machine has become worn or obsolete, it can be entirely rebuilt and modernized in the Modern Collet plant. Similar products and services are available from other sources, but in no other case can they be supplied by one company to cover every type of screw machine.

The parts and tools manufactured by Modern Collet offer many patented features of design and construction unequalled in any other products. A number of them—as in the case of feed fingers—are more widely accepted and used than any others.

In the field of rebuilding and modernizing, the department in the Modern Collet plant devoted to this work is unique. It occupies a large area in the new factory addition, and has every production-line facility for efficient handling of hundreds of machines.

If you operate one screw machine or five hundred, Modern Collet offers every part, tool or service to keep your equipment operating at peak efficiency.

## MODERN COLLET and MACHINE CO.

401 Salliotte Street

Ecorse, Michigan

nose of the clamp piece can be case hardened so that it will not be drilled into easily. The screw in the nose serves as an extension when drilling gears with a large bore.

### Morrison Machine Name Discontinued

Effective June 2, 1941, the name Morrison Machine Products Division of Hardinge Brothers, Inc., Elmira, N. Y., will be discontinued and all business of this firm will be carried on under the name of Hardinge Brothers, Inc. This consolidation is for the benefit of the many customers of both divisions in that the one name—Hardinge Brothers, Inc.—will concentrate correspondence, shipments, and accounts under one name instead of two as formerly.

### Rockford "Economy" Lathes

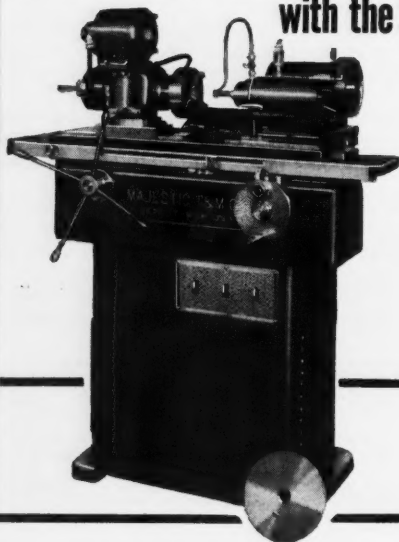
The line of Rockford "Economy" Lathes formerly manufactured by the Rockford Machine Tool Company, Rock-

ford, Ill., has been taken over by the D & M Machine Works, Torrance, Cal. All drawings, patterns, jigs, fixtures, and other tools pertinent to the manufacture of this line have become the property of the D & M Machine Works, who will manufacture the lathe to the standards of accuracy and workmanship which have characterized Rockford "Economy" Lathes in the past.

**Reznor Gas Fired Suspended Unit Heaters.** A line of Reznor Gas Fired Unit Heaters, which includes fan type, blower type, and duct type units, is described in Catalog U41 issued by the Reznor Mfg. Co., 179 James St., Mercer, Pa. Each type of unit is available in five different capacities ranging from an input of 55,000 b.t.u. per hour to an input of 200,000 b.t.u. per hour.

Catalog U41 comprises 12 pages, 8½ x 11 in., and is fully illustrated with drawings and photographs which show the important construction features of the various types of units. It is punched with standard three-hole punching for easy filing. Copy free upon request.

## SIMPLIFIED INTERNAL GRINDING with the MAJESTIC INTERNAL GRINDER



An exceptionally wide range of internal grinding jobs can be handled on the New Majestic Internal Grinder. Its simplicity of design and ease of operation are features of utmost importance in providing maximum grinding output at low cost.

### SPECIFICATIONS

Length of table, 48". Swing over table, 10". Travel of cross slide, 2½". Precision dial graduated to .0001". Precision bearing work head. Speeds — 100, 225, 350 r.p.m.

Write for complete details contained in New Bulletin

**Majestic Tool & Mfg. Co.**  
2950 E. Woodbridge Detroit, Mich.



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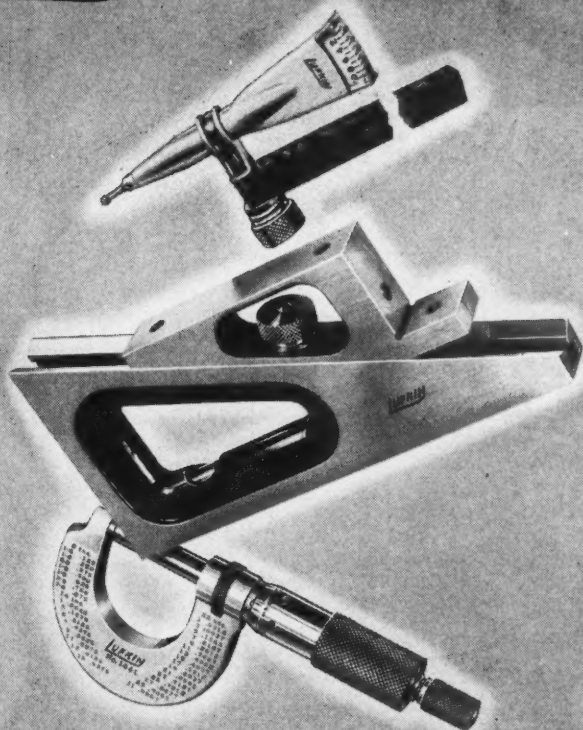
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Co.  
Mich.

June, 1941

# **LUFKIN** FOR HIGH-SPEED ACCURACY



Today, more than ever the demand is precision tools that get **ACCURATE** results **RAPIDLY**. That's where Lufkin comes in. Years and years of designing new tools, improving existing ones, and manufacturing to the most rigid quality specifications have built into Lufkin products the very thing machinists most need today. **BUY THROUGH YOUR DISTRIBUTOR.**

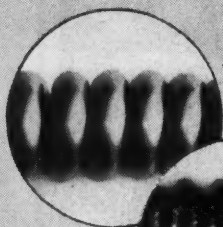
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**THE LUFKIN RULE CO.**  
SAGINAW, MICHIGAN

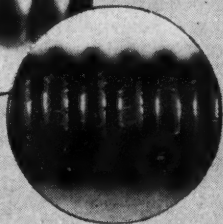
Canadian Factory  
WINDSOR, ONT.

**TAPES — RULES — PRECISION TOOLS**

# Inner Strength



## ★ New FORMEX WIRE maintains its dielectric film under severe conditions



The top photo shows Formex wire stretched 20 per cent and wound on its own diameter. The lower picture shows enameled wire stretched 10 per cent and wound on twice its diameter. The Formex wire is not damaged.

## Extra Protection

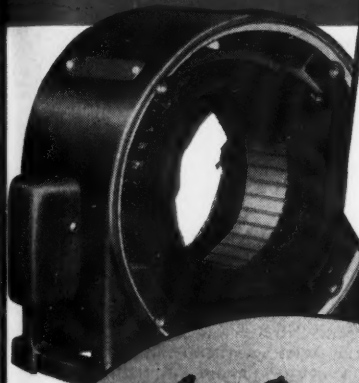
against physical damage

Strong, one-piece, cast-iron frame and end shields, with upper portion enclosed, protect vital motor parts.

...built for  
protection first  
...to last!

G

# th Begins WITH FORMEX<sup>★</sup>



## NO "MUMMY INSULATION" HERE

With Formex wire, G-E engineers were able to "take off the wraps" on random-wound motors. Away went organic "mummy" coverings and heat-enclosing compounds. Having Formex wire, G-E engineers built a stronger, tougher motor insulation.

## Extra Protection

against electrical breakdown

When G-E engineers designed the Tri-Clad motor, they saw that the toughness of Formex wire insulation opened up new opportunities for strengthening the entire coil assembly from the inside out—giving it *inner strength*. They utilized new G-E synthetic-resin bonding varnishes to give rigidity and extra resistance. They selected for application on end turns a coating of Glyptal No. 1201 Red as an additional armor against adverse operating conditions.

Thus, in the Tri-Clad motor you get a more compact winding—one that dissipates heat quickly and keeps the motor young. Make sure your next motors are Tri-Clad. General Electric, Schenectady, New York.

Integral-hp sizes up to 20 hp (at 3600 rpm), open or splashproof, are now available—also capacitor-motors in sizes up to 5 hp.

Write for our new Tri-Clad motor bulletin, GEA-3580

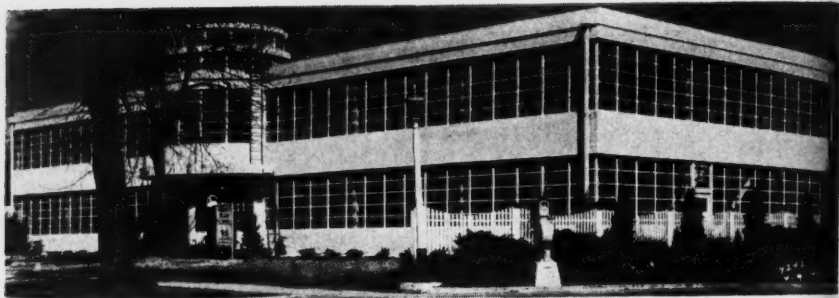
## Extra Protection

against operating wear and tear

Sleeve bearings of new design have longer life, greater capacity, improved lubrication features. Sealed ball bearings retain lubrication, exclude dirt.

# GENERAL ELECTRIC

750-50E-8058



## New Hobart Trade School

The Hobart Trade School Inc., shown above, was opened to students in April by Hobart Brothers, Troy, Ohio. With facilities for training 80 students in arc welding, the school had a full registry for its first few weeks of operation. The trade school is a non-profit organization established for the purpose of bettering the welding profession by sending trained and qualified men into the field.

The neoteric structure is an excellent example of the fabrication methods taught in the school—being built entirely of arc welded steel and glass. Perhaps the most interesting architectural feature of the building is the circular entrance tower inside of which is a visi-

tor's vestibule and lounge. The second floor of the tower is reached by a circular arc welded steel staircase.

The main course of study offered in the school consists of 160 hours of training thoroughly covering the metallic arc welding of steel with both plain and coated electrodes. Each student is advanced as rapidly as his own work justifies. The length of time required by students to become adept varies, of course, with each individual student, but the average period of training time is four weeks.

Each student has the private use of an individual welding booth equipped with welding bench and machine. An arc welded ventilation system separately connects each of the school's 50 welding booths. Ventilation may be regulated by each student in his booth according to his desires. Slide curtains provide eye protection from the arc in the aisles of the school.

A recent sample poll of former students showed that practically every Hobart student procures welding employment immediately following completion of the training course—and a waiting list is always ahead for specially equipped students.



Every  
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that offer

- Maxim
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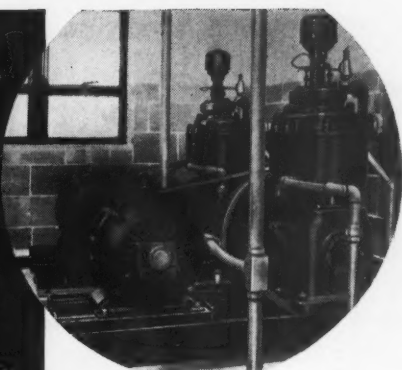
# LOWER

## *Your Costs for Air*

### with CURTIS

#### MODEL "C"

## Air Compressors



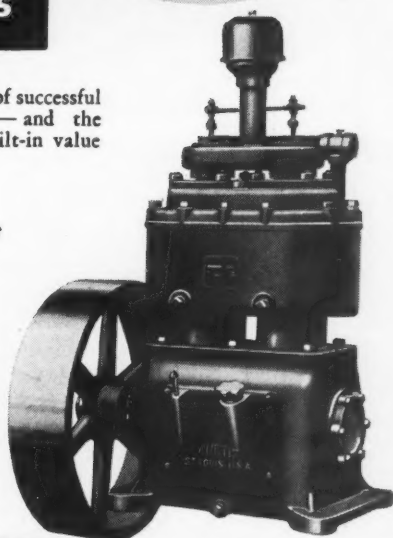
Every Curtis Compressor reflects Curtis' 86 years of successful engineering and manufacturing experience — and the result is the advanced engineering and honest built-in value that offers you:

- Maximum capacity per dollar of first cost
- Highest volumetric and mechanical efficiency
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- Lowest maintenance expense and oil consumption

And actual operating records prove the fact that Curtis Compressors deliver dependable air service at minimum cost. With Curtis Compressors you can benefit in two ways — by replacing your present overloaded outworn and inefficient equipment and by extending the use of air operated equipment in your plant. More and more, air power is being used to operate modern equipment.

Curtis economy is the result of such design features as Timken Roller Bearings, Carbon-free Disc Valves, Centro-Ring Oiling, Automatic Pressure Unloader, and Precision Workmanship throughout, with all parts readily accessible; furnished in capacities up to 360 cfm.

*Let us send you proof of Curtis economy. Full information will gladly be sent upon request. Send coupon for booklet, "How Air Is Being Used In Your Industry."*



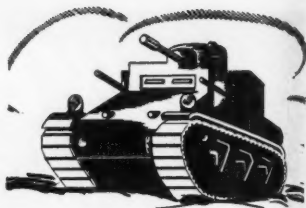
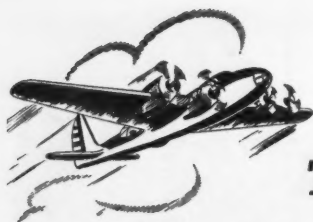
CURTIS PNEUMATIC MACHINERY COMPANY  
1913 Kienlen Avenue, St. Louis, Mo.  
Please send me booklet "How Air  
Is Being Used in Your Industry."

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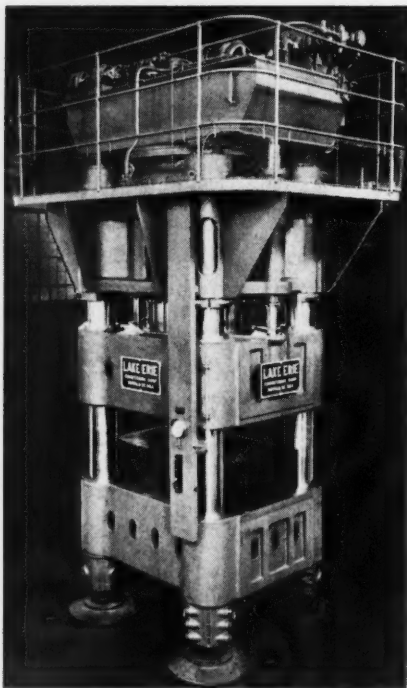




## Tools For National Defense

### Lake Erie 5,000-Ton Single-Action Hydraulic Aircraft Press

The illustration shows a 5,000-ton single-action hydraulic aircraft press, furnished with rubber pad and steel bolster together with automatic motorized loading tables for high production of air-



Lake Erie 5,000-Ton Single-Action Hydraulic Aircraft Press

craft parts, which has been announced by the Lake Erie Engineering Corporation, Buffalo, N. Y. The press is self-contained, with the pumping unit located at the top.

The standardized design of this press is said to make possible many applications in the metal forming field. The design combines fast operation, low cost of dies, quick changeover of dies, quick handling of stock and finished pieces, and convenient control of pressure—all of which are intended to result in high output and low costs on both volume and limited production.

Features of the press include push button controls which are grouped in conveniently located panels that are easily accessible to operators. The controls are interlocked for safety so that when two or more men are operating the press, the press cannot be started until the push button controls on both sides of the press are operated. Controls are provided for starting, stopping, semi-automatic operation, and inching. Adjustable pressure and stroke controls are also provided.

### Big Boring Mill Speeds National Defense Production

The giant 40-foot boring mill shown in operation here, one of the world's largest, was recently installed at the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company to speed the construction of large power equipment for the nation's national defense program.

At present, the huge mill is machining stator frames for some of the larger





*Speed Up*

**GEAR  
CHECKING**

**WITH**

**RED RING**

**UNIVERSAL GEAR TESTER  
AND LEAD COMPARATOR**

Red Ring Universal Gear Testers will check index, interference, helix angle, wobble, eccentricity and tooth size of the ordinary small gear in less than a minute, making it useful for production inspection.

Operation is simple, easy—requires no extraordinary skill. Readings are to .0001".

The Red Ring Helical Gear Lead Comparator compares the lead of each tooth to that of a precision master gear, or to a master disc. Set up is simple and easy, and once the job is set up almost any workman of average skill can make the inspections.

Gears integral with the shaft—arbor mounted gears—or internal gears may be checked.

Both gear testing machines are extremely sturdy, high precision instruments. They will make a large reduction in gear inspection time and cost.

Write for data on these and other Red Ring Machines.

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN

DETROIT, MICHIGAN



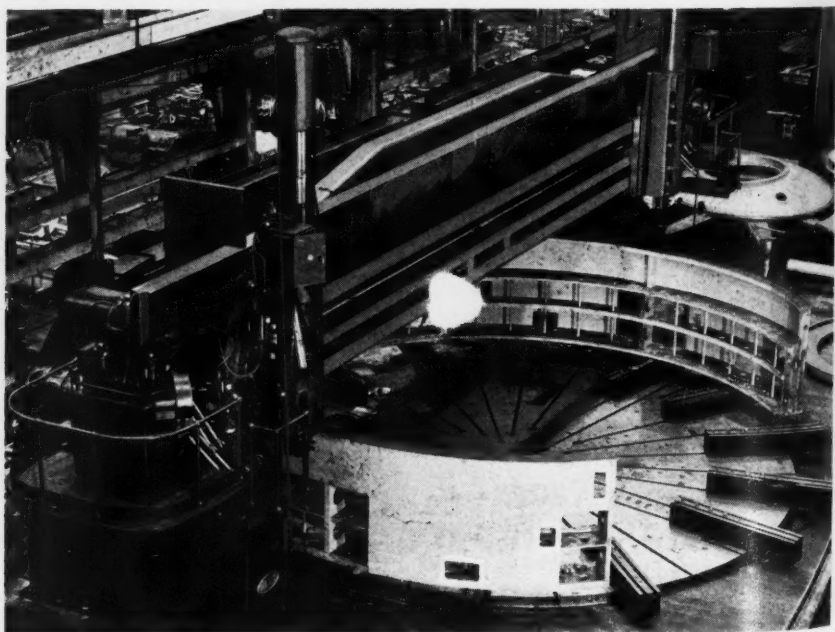
This close-up of the boring operation on a 30,000-kw waterwheel generator stator frame at Westinghouse's East Pittsburgh Works shows the operator checking the diameter of the machined bore with a pin-gauge. A standard reund-nose high-speed steel roughing tool is used, securely held in the tool post of the vertical ram. Though not visible in the picture, another ram of equal size, and fitted with a like tool is cutting metal at the other side of the frame—thus both tools are removing metal simultaneously.

waterwheel generators being built for various new dams now under construction throughout the country. Now that it is operating, the mill simplifies the work involved in machining these large fabricated structures by eliminating the necessity of special machining set-ups to

accommodate the large diameters involved, thus saves valuable time in the construction of such large machines as these waterwheel generators.

In the picture below, some of the steps in the machining of a 30,000-kw stator frame for a waterwheel generator are shown. Two main jobs are performed by the boring mill. It bores the inside ribs

In the set-up operation, after it is completely assembled on the turntable, the frame is centered prior to the commencement of machining operations. Work such as this is performed on the 40-foot boring mill just recently installed at Westinghouse's East Pittsburgh Works.



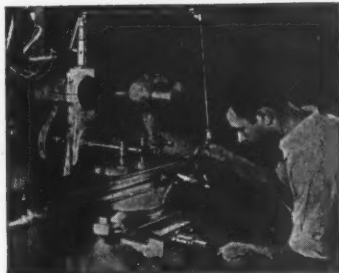
Illustrating  
Dazor Floor  
in literature

# Float your light



**exactly where  
you want it . . .**

***It stays put!***



*Illustrating the flexibility of the  
Dazor Floating Lamp. Can be placed  
in literally hundreds of positions.*

Yes, float this lamp to any position with the touch of a finger. It stays there. No adjusting or locking, because a spring scientifically counter-balances the arms.

You raise or lower the Dazor Floating Lamp in just a second. Push, pull or twist it; swing it in a complete circle—always the same firm, stationary light, exactly where you need it.

For shop work, localized light is essential: to curtail glare and eyestrain . . . to promote safety. The Dazor Floating Lamp fastens directly to lathes, drills, presses, shapers, milling machines, benches, drafting boards, desks, walls, business-machine stands—anywhere. Also, a portable pedestal type, as shown at left.

Appointed electrical wholesalers have the Dazor Floating Lamp for quick delivery. Call your supplier now . . . or write for literature and distributor's name.

**DAZOR MANUFACTURING CORP.**  
4483 Duncan Ave. St. Louis, Mo.

## **Dazor Floating Lamps**

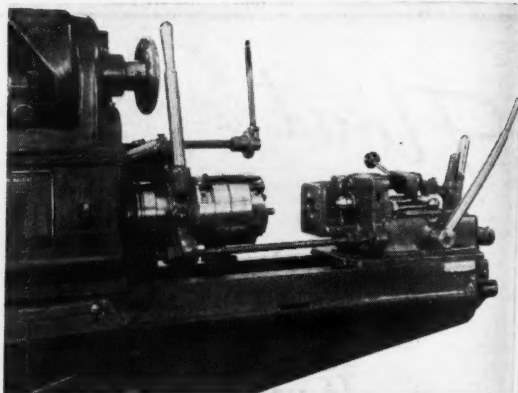
**Fluorescent and Incandescent**

# Landis Special Holding Device for Threading Shell Caps

of the stator frame to the correct diameter for stacking the sheet steel laminations that will carry the stator windings. After the frame is bored, and while in the same setting on the boring mill, the top flange is faced. During these machining operations, approximately 10,000 cubic inches of metal are removed. The turntable of the mill revolves at about 0.34 revolutions per minute.

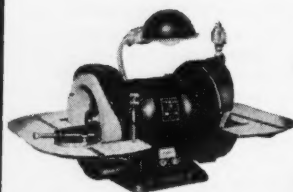
## Landis Special Holding Device for Threading Shell Caps

Illustrated herewith is a fixture recently developed by the Landis Machine



Company, Waynesboro, Pa., for holding 37 mm. shell caps rigidly in alignment for threading. This special holding device comprises a hardened and ground supporting bushing, a supporting center, and a supporting center-locking member.

In operation, the shell cap is placed on the supporting center while in the position shown in the accompanying



**MODEL AA**

**\$99.50**

**Write for details  
of free trial offer.**

## Prosser CARBIDE TOOL GRINDER

Removes metal fast when rough grinding.

Finish grinds smooth, keen cutting edges.

Oversize 7" wheels give greatly increased wheel life.

This grinder will quickly pay for itself by increased tool performance and life between grinds.

**THOMAS PROSSER & SONS**  
120 WALL STREET NEW YORK

illustration. The center is then moved forward until the work enters and seats in the supporting bushing. The work is then locked into position for threading with the supporting center-locking lever. The entire unit is adjustable both horizontally and vertically to assure perfect and permanent alignment of the work with the center of rotation of the threading die head, thus assuring the production of concentric threads.

This work-holding fixture for 37 mm. shell caps is designed for use on the Landis  $\frac{3}{4}$ -In. and  $\frac{7}{8}$ -In. Single or Double Head Threading Machines. The shape of the parts will not permit gripping on the outside surface and makes it necessary to employ this socket-type fixture and an internally tripped die head. Any slight variation in size would change the location of the work in the fixture. Thus, the internally tripped die head prevents any possibility of the chasers striking the shoulder of the work and it also assures threads of uniform length.

Due to the fine accuracy required for the thread, it is recommended that the

die head be of the hardened and ground type and also that the machine have a leadscrew attachment. The leadscrew will assure a correct start of the die head onto the work so that the first threads are accurately formed.

### H-P-M Hydraulic Press for Forming Fuselage Parts

The 5,000-ton H-P-M hydraulic press illustrated here—product of The Hydraulic Press Manufacturing Company, Mt. Gilthead, Ohio—is now being put into production service in England for forming the fuselage parts for bombers. The feature of the press is the use of a type of construction which makes possible the use of inexpensive dies. A large rubber pad, 168 x 50 in., is recessed into the bottom of the press platen, taking the place of what would ordinarily be the upper die or punch. Inexpensive lower dies, made from masonite and reinforced with steel at their cutting edges, are made on the press bolster plate. This

## Prosser

### NEW HEAVY DUTY CARBIDE TOOL GRINDER

This machine has all the features of the smaller machine plus ample power for the heaviest tools.

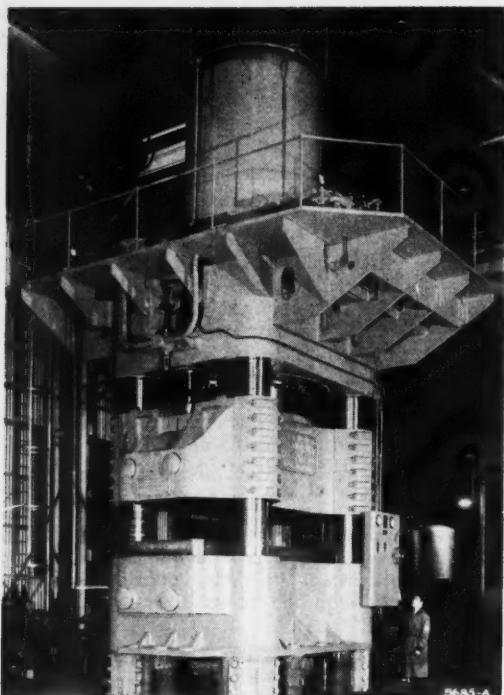
- PROVISION FOR WET GRINDING.
- QUICK-ACTING INDEXING TABLES.
- HIGH GRADE BALL BEARING SPINDLE.
- DOUBLE V-BELT DRIVE.

Also grinds high speed steel, stellite, etc.

Write for complete details.



THOMAS PROSSER & SON  
100 WALL STREET NEW YORK



5,000-Ton H-P-M Fastraverse Press for Fuselage Work

method of cutting and forming metal aircraft parts is known as the "Guerin" process.

This 5,000-ton H-P-M hydraulic press is said to be the largest self-contained hydraulic press ever built. The cast steel cylinder alone weighs 170,000 lb., the cast steel bed weighs 130,000 lb., and the

cast steel platen weighs 125,000 lb. Two thousand gallons of oil are required for operation and two 150 h.p. motors provide power to drive the four radial piston-type pressure generators.

The press is equipped with the H-P-M closed circuit operating system. Press reversal is accomplished by reversing the discharge of the radial-type pressure generator. No operating valves are employed. Smooth, shockless press operation is obtained. The radial pressure generators are of the multiple plunger positive displacement type and, driven at constant full motor speed, will deliver the oil used as a pressure medium from either port and in variable volume according to the demands of the controls. The radial pumps are equipped with Timken tapered roller bearings, separating vital working parts. The bearings can be taken up without dismantling the pump.

### Shell-Cleaning Equipment

Of all the problems involved in shell production, there is one that has stood out like a sore thumb—the cleaning operation. Heretofore this process has generally been slow, often inefficient, and always relatively expensive. The situa-

## DICKERMAN DIE FEED

FOR QUICK SET-UPS ON SHORT OR LONG RUNS



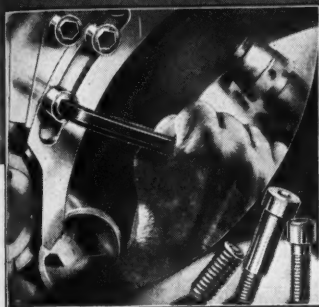
Handles coiled stock of any practical thickness. Maximum stock width 4". Adjustable from 0 to maximum feed length of 3" in increments of .001". Accurate.

**H. E. DICKERMAN  
MFG. CO.**

321 ALBANY ST.  
SPRINGFIELD, MASS.



## FOR SPEEDIER HOLLOW SCREW SET-UPS



**ALLEN KEY SETS**  
keep hex keys handy  
all the time! . . .

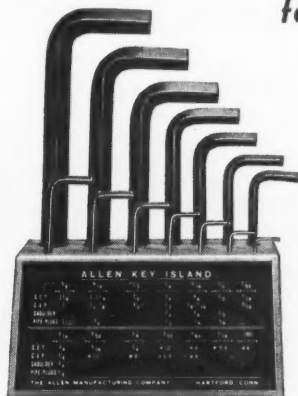
These compact Allen Key Sets save time wasted in hunting after the correct size hex key for hollow screw assemblies, adjustments or replacements. With Allen Key Kits and Key Islands you have readily available strong, accurate keys *where* you want them, *when* you want them, in sizes to fit most standard hollow set, cap and shoulder screws and pipe plugs. Call on your local Allen Distributor to supply these handy units in any of the following assortments:



### ALLEN KEY KIT NO. 603

Contains a complete set of 11 short arm *normalized* hexagonal keys which fit all screws up to and including 1 1/4 inch diameter set screws. Packed in cloth container. LIST PRICE \$1.75.

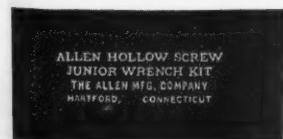
*for your  
Bench*



### ALLEN KEY ISLAND NO. 615

Contains 14 keys in metal stand plainly labeled to show the correct size key to use with each screw. Keys fit set screws up to and including 1 1/4"; cap screws up to 1", shoulder screws to 3/4" and pipe plugs to 1". LIST PRICE \$2.35.

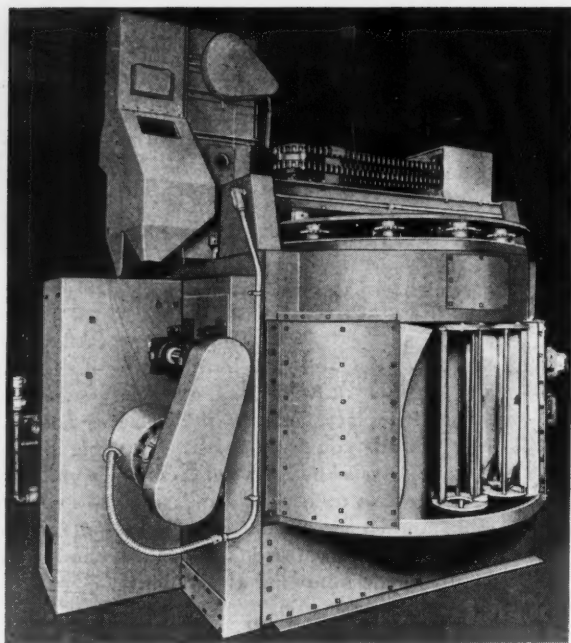
Ask for Folder X-19



### ALLEN JUNIOR KEY KIT NO. 604

Seven short arm Allen Keys are included in this strong leather container. Keys fit the hex holes of sizes Nos. 8, 10, 1/8, 3/16, 1/4, 5/16, 3/8 and 1/2 set screws and Nos. 4, 5, 6, 8, 10, 1/4 and 3/8 cap screws. LIST PRICE 50 cents.

**THE ALLEN MANUFACTURING COMPANY**  
HARTFORD, CONNECTICUT, U.S.A.

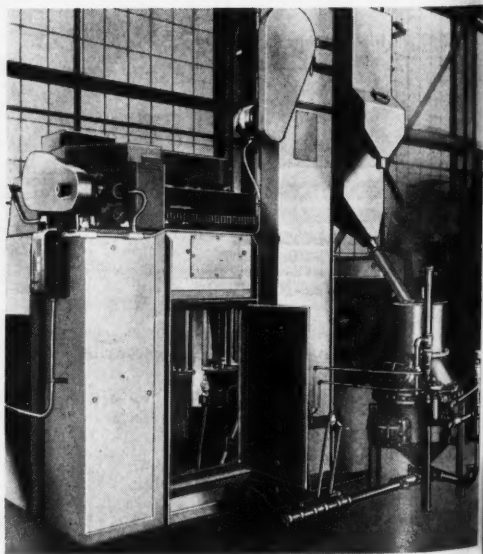


American Foundry Equipment Company's Shell-Cleaning Machine, Showing Loading and Unloading Position and Wheelabrator Unit

tion needed correction, but it would obviously require equipment of an entirely new design.

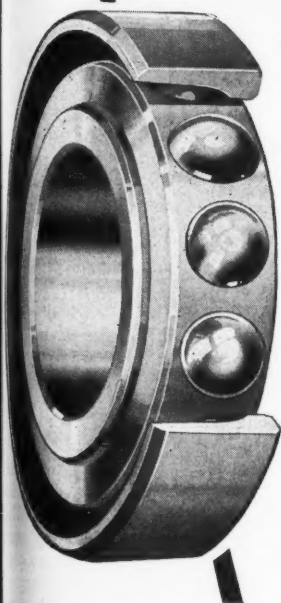
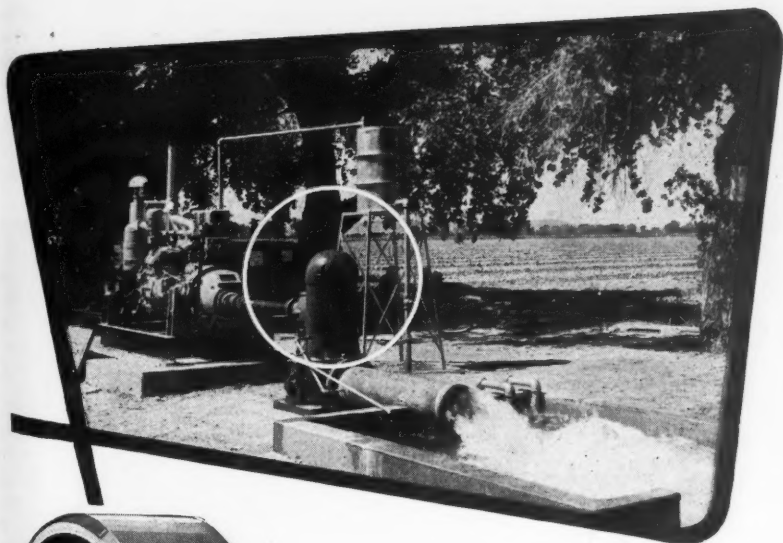
Long before the pressing need for such equipment became imminent, engineers of the American Foundry Equipment Company, Mishawaka, Ind., began studying the subject. Having designed machines for this work during the World War, they were well acquainted with the problems to be solved. The design of the new equipment incorporates four new features intended to provide greater production and to economize on the use of

compressed air; (1) The machine is arranged so that the blast nozzles are never shut off. This eliminates lost nozzle efficiency when starting off or shutting down. (2) Conveyor timing is incorporated in the new design. (3) The shells are successively indexed over three nozzles aimed at different points on the interior of the shell so that the entire interior surface is struck by abrasive on the initial discharge from the nozzle. (4) The new design permits the addi-



View of Rear of Shell-Blasting Machine Showing Access Door and Continuous Tank Arrangement

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## *A Gear Drive Using McGILL Bearings*

So rigid are the tests made by the Johnson Gear and Mfg. Company, of California, on its "Right Angle" Gear Drive before release, that all adjustments are permanent.

Three different types of McGILL Precision Ball Bearings are used to support the gears and carry the loads. The same values that prompted the selection of McGILL bearings are available to you. Our engineers will cooperate. Write us.

BEARING DIVISION

**MANUFACTURING COMPANY**  
1500 North Lafayette Street  
**VALPARAISO, INDIANA**

MODERN MACHINE SHOP 185

**Just build  
the walls  
around it!**

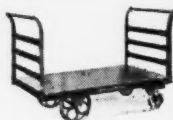


◀ **Fig. 732**  
Pat'd. and Pat's. Pend.  
**Drawer is extra**  
**BENCHES IN**  
**1367 MODELS**

**TRUCKS OF** ➔  
**ALL TYPES**

Pat. App. For

**Fig. 754**



Plan the shop for the equipment, or fit the equipment to the shop . . . Defense plants, new and old, find in the "Hallowell" lifetime line of standardized steel shop equipment, units that fit perfectly the production layout and the job — at costs generally far below that of building ordinary wooden equipment!

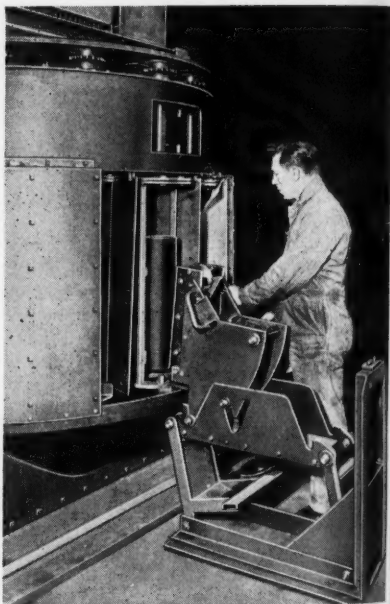
For the fastest way to take your plant out of construction and into production write — **STANDARD PRESSED STEEL CO.**, Box 556, Jenkintown, Pa.

## "HALLOWELL" STEEL SHOP EQUIPMENT

**Benches • Stools • Trucks**  
**Tool Stands • Hangers and Collars**

tion of auxiliary equipment to clean the outside of the shell in cases where manufacturers wanted to eliminate the exterior scale in order to save expensive tools.

The new shell-cleaning equipment cleans the interior of the shells by air pressure, using air blast nozzles because



**Loading Device in Elevated Position as Shell Is Placed In or Removed from Hanger**

of the small opening in the end of the shell. However, the cabinet is designed so that an airless Wheelabrator unit can be added as auxiliary equipment for cleaning the exterior of the shell. The new design is said to reduce by one-half the amount of compressed air previously required for a given production. In one plant where this machine has recently been installed, it is cleaning 5,000 shells of 75 mm. size in 20 hours or 250 shells per hour. Two 5/16-in. nozzles are used with a total requirement of compressed air of 290 to 420 cu. ft. per minute. In another plant where a similar

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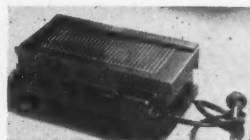
June



# HOLD LARGE WORK



and small work



ABOVE: Superpower Chuck with fine-mesh faceplate for holding small work.

AT LEFT: Large Superpower on 30" x 48" x 120" grinder in Taft-Peirce plant.

## - on Taft-Peirce Superpower Magnetic Chucks

The complete line of Superpower Magnetic Chucks includes rectangular and rotary models, each with plenty of holding power and durability to stand up to today's high speeds and feeds. Taft-Peirce also manufactures a full line of accessory equipment: control switches, demagnetizers, magnetic

parallels (in two sizes) and the V-Blocks.

Learn how Taft-Peirce Superpower Magnetic Chucks can increase the versatility and production of grinders, millers, planers, lathes, and shapers. . . Write on your letterhead for a copy of the 1941 Taft-Peirce Handbook.

THE TAFT-PEIRCE MANUFACTURING  COMPANY  
WOONSOCKET, RHODE ISLAND

machine has recently been installed the unit is cleaning 720 shells of 60 mm. size per hour, using five 5/16-in. nozzles with an air requirement of 725 to 1,050 cu. ft. per hour.

### Lubricant for Drawing Cartridge Cases

Among the items which are required in large quantities for defense purposes are cartridge cases for 75 mm. cartridges and those of other sizes. These cartridge cases are drawn from a 70 per cent copper alloy and the interesting feature of the job is that no scratch—not even the slightest—is allowed on the surface of the metal. The finish must be practically perfect.

This production operation is rapidly becoming a large production reality, as cases will be required for millions of shells. The job usually includes four operations of which the third is the most difficult due to the fact that in this operation is the greatest change made in the

shape and thickness of the shell. In the first operation the piece is blanked from the sheet stock, then the blank is drawn to form a cup, after which it is drawn and redrawn until it is a highly finished casing. In these drawing operations the item of lubrication is important. The pieces are lubricated before drawing and are then washed immediately after coming out of the press, before the next draw, to remove any particles which might cause any scratch in the subsequent drawing operation. It is important, of course, that the lubricant have the required properties in order to serve its purpose, but it must also be soluble in water so that it will easily be removed in the washing operation.

A new lubricant, to be known as the No. 1025 Nonscratch, has been developed for this operation by the Wayne Chemical Products Company, 9448 Copeland Ave., Detroit, Mich. No. 1025 Nonscratch may be diluted with five times as much water in making up the lubricating solution. Various tests have shown that when this lubricant is used, a very consider-



## MAGNETIC CHUCKS

No. 618 Standard Type Rectangular Magnetic Chuck. Available in sizes 4" x 8" to 30" x 96". Ask for Circular W4.



**O. S. WALKER CO., INC.**  
WORCESTER MASS.

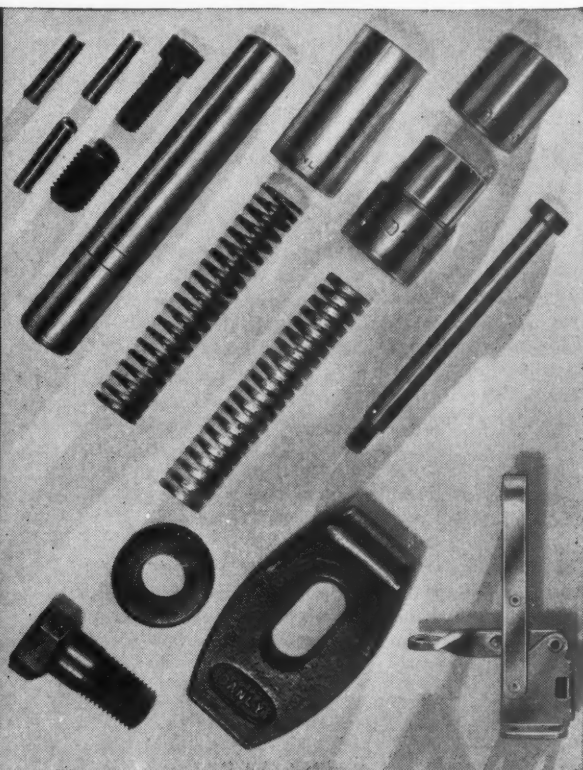


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Ducommun Metals & Supply Company, Los Angeles, California; San Francisco, California

# DANLY DIE SETS and DIE MAKERS' SUPPLIES

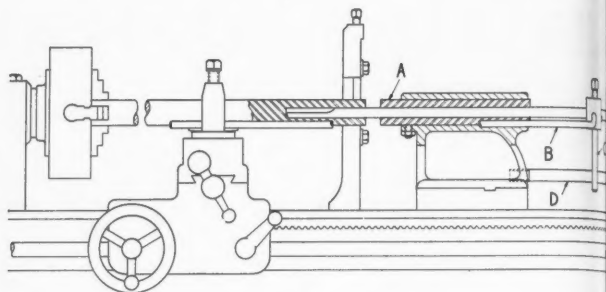
able increase in the number of casings made between stops for honing the dies is produced. A working sample will be furnished to interested firms without cost.

centered in a steadyrest, as shown in the illustration, the tool being operated from the tailstock. The regular center quill together with the tailstock ram, screw

## Atlas Gun Drill- ing Equipment

Equipment especially designed for drilling gun barrels and similar work with deep holes, to be used with the standard Atlas 9-in. or 10-in. engine lathe, is now being offered by the Atlas Press Company, 546 N. Pitcher St., Kalamazoo, Mich. The tools are of simple design and the change-over for gun drilling is easily made.

One end of the workpiece is held in the lathe chuck and the other end is



Atlas Lathe with Gun Drilling Equipment

bearing, and wheel are removed from the tailstock and a special gun drill quill is substituted, as shown, so that a standard-type gun drill can be used. The quill is indicated at A.

Provision is made for feeding the drill

## YOU CAN EXPAND THIS REAMER .0001" EASILY AND QUICKLY

Easy, rapid adjustment to .0001" is possible in a Staples reamer due to its patented tapered expansion plug. The range of expansion is from .004" in a 1/4" dia. reamer to .020" in a 1 1/2" dia. reamer. Due to construction, each expansion of the reamer further tilts the blades, presenting in effect, a new cutting edge. It is not unusual to find Staples type Carboly-tipped reamers expanded several times without a regrind and without affecting the finish of the hole. This enables you to hold accurate sizes with a minimum servicing of the reamer. Sizes from 1/4" dia. to 1 1/2" dia. Write for leaflet. Sold through Carboly Company or direct from . . .

**STAPLES TOOL & ENGINEERING Co.**

Cincinnati, Ohio



Resizing automatically provides clearance without regrinding!

# STAPLES REAMERS CORE DRILLS

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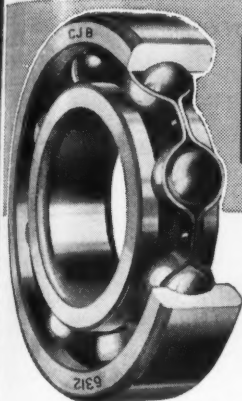
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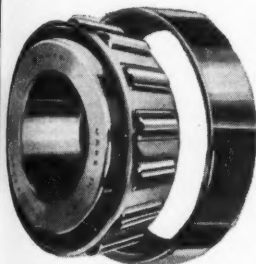
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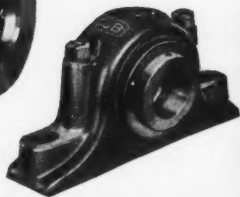
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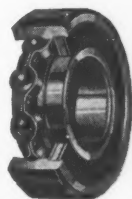
# BEARINGS

## *all Types*

THERE ARE standard **(CJB)** Ball Bearings and Bower Roller Bearings for most applications. The higher speeds and more exacting requirements industry demands of equipment today call for better bearings. Whether you design new machines or modernize present equipment, **(CJB)** Ball Bearings and Bower Tapered Roller Bearings will do the job efficiently, economically and satisfactorily.

**(CJB)** Ball Bearings have large balls for capacity — deep grooved rings for strength—and mirror-finish raceways for smooth performance and long life.

**BOWER** Tapered Roller Bearing raceways are "Super-Finished" for extreme accuracy and quiet operation. Maximum capacity and long life are obtained through positive roll alignment—heavy thrust shoulder—and constant roll end lubrication.



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**CHICAGO, ILLINOIS**

MODERN MACHINE SHOP 191



by using a feed rod which is clamped to the rear end of the gun drill at one end and in the toolpost at the other. A portion of the feed rod, *B*, is bent near the rear end at right angles and the end is threaded into a tapped hole in a collar which is also reamed so that it can be slipped over the end of the drill. A setscrew in the collar provides for anchoring it to the drill. Also threaded into a tapped hole in the collar is a short section of steel rod *C*. A guide rod, *D*, of heavier stock, is threaded into a tapped hole in the rear end of the tailstock to serve as a guide against which the rod *C* can rest to keep the feed rod in alignment.

The front end of the guide rod, being clamped in the toolpost, feeds the drill into the workpiece when the machine is operating with the feed locked. Any of the regular feeds available on the lathe can be used. As the drill is fed into the work the feed rod can be adjusted by changing the setting of the feed rod collar or resetting the rod in the lathe toolpost.

## Marking Tool for Shells Announced by New Method

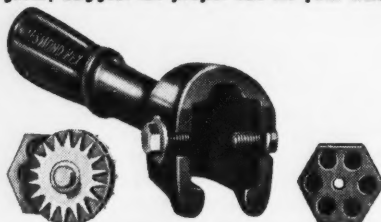
Developed especially for marking parts such as shells or other ordnance units, indexing rolls, and similar parts, while being produced on automatic screw machines or lathes, New Method Steel Stamps, Inc., Detroit, Mich., is now manufacturing a rotary or roll-type marking device with solid die. Service installations on more than a dozen automatic screw machines turning 37 mm. shells have shown their ability to automatically make clean-cut identifying marks in high production.

As may be noticed from the illustration, which shows the device in use on an automatic screw machine, the marking roll fits into a holder which has a fine adjustment for starting the marking operation when the roll is brought into contact with the part. After completing the marking operation, the roll is returned to initial position by a coiled spring mounted on the end of the roll shaft. The roll is so designed that con-

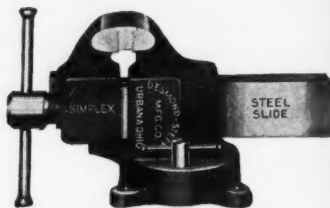
## GRINDING WHEEL DRESSERS--VISES

We manufacture the only complete line of Grinding Wheel Dressers and cutters and will gladly suggest the proper one for your wheels.

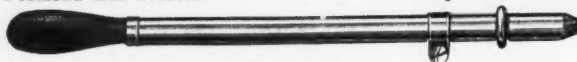
The exclusive solid steel slide makes Simplex Vises stronger and more serviceable.



Desmond Hex Dresser



Simplex Machinists' Vise



Desmond Diamo-Carbo Dresser, best tool room dresser.

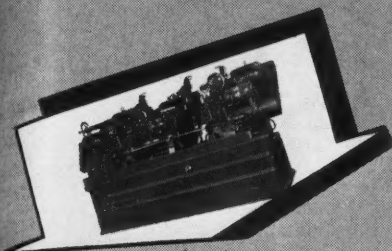
Write for catalog *M* showing complete line of Desmond Dressers and Simplex Vises and name of your nearest dealer.

**DESMOND-STEPHAN MFG. CO., URBANA, OHIO**  
Canadian Desmond-Stephan Mfg. Co., Ltd.—Hamilton, Ont.

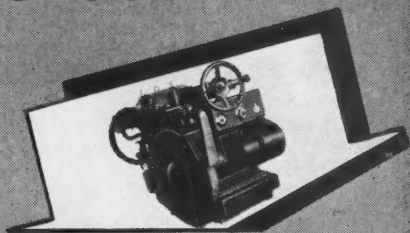


# FITCHBURG

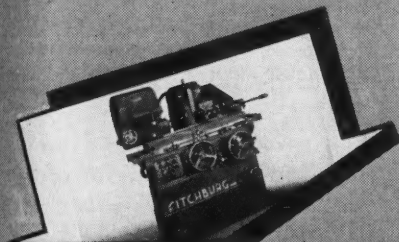
## shows the way to cut GRINDING COSTS



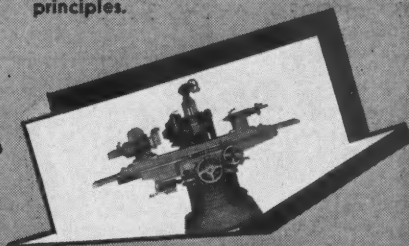
*On Mass Production Work with Automatic Multiple precision grinding with special machines like these using standard Bowgage Wheelhead units.*



*On High Speed Work Bowgage Wheel-head units like this can be mounted on your present machines to increase production and accuracy control by a new application of accepted mechanical principles.*



*On Plain Cylindrical Work by cutting out costly frills not needed on normal work and standardizing on low cost, rigidly accurate, long-lived Fitchburg Grinders. They cost less to start with, save money as you use them.*



*On Tool Room and Small Lot Work with Bath, fully universal grinders, easily and quickly adaptable to external, internal, surface, gear cutter and tool grinding. With this one machine you can do a wide range of precision work.*

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- Without obligation you may send us latest literature on machines checked:
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NAME.....

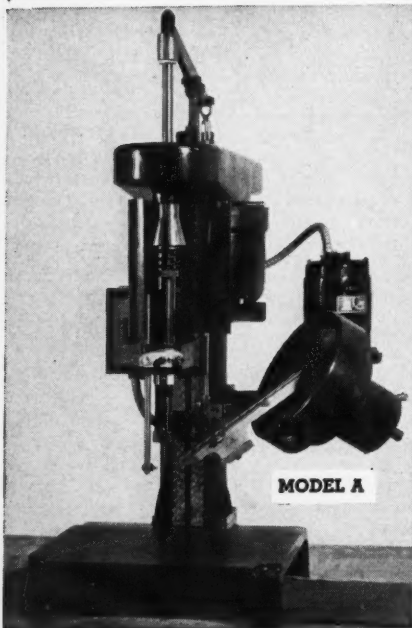
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# THE MODERN WAY TO DRIVE SCREWS

**Your Screwdriving  
Problems Solved By  
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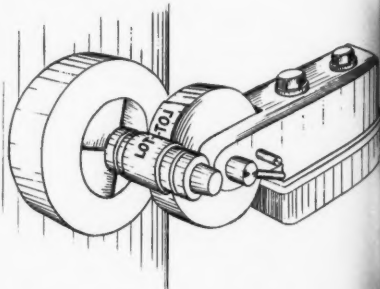
SEND SAMPLES FOR PRODUCTION  
ESTIMATES AND COMPARE WITH  
YOUR PRODUCTION

**Detroit Power  
Screwdriver Co.**

5375 ROHNS AVE., DETROIT, MICH.

tinuous contact with the part after marking does not cause it to rotate and mark the surface. Only a single impression is made, even though the part continues to rotate before the roll is withdrawn from contact.

Various forms of holder shanks are available so that the device can be



New Method Roll-Type Marking Device  
for Marking Shells

adapted to most applications where the marking of rotating parts in production is required. Another type with interchangeable die has also been developed

## Houghton Ready-Mixed Cutting Oils for Gun Barrels

Ready-mixed cutting oils for drilling, reaming and rifling gun barrels for small arms—.30, .45 and .50 caliber—are announced by E. F. Houghton & Co., Philadelphia, Pa. For many years this company has supplied a cutting base mixed in the user's plant with a suitable blending oil and fed under high pressure through the barrels during the drilling operation. Some plants were found to prefer a ready-to-use oil when taking defense contracts, thus eliminating the possibility of error in mixing or diluting.

For drilling, Houghton's W. R. Cutting Oil No. 5 is now being used with excellent results in this difficult machining job. For reaming and rifling, Cut-Max No. 1025, a light-colored non-staining oil, is

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June, 1941

# Flame-Cut Steel Plate Quickly!



Lower costs for cutting steel plate and sheet is your reward when using the 41 lb. motor-driven Airco No. 10 Radiagraph. With this oxyacetylene cutting machine you can do the job quickly, easily. It automatically cuts square or bevelled edges on circles from 3 inches to 85 inches in diameter . . . and it will make straight cuts of any length.

The Radiagraph is supplied complete with torch, tip and one track for a 60 inch long straight line cut. It is available for operation on either a.c. or d.c. For more detailed information, please write to any Airco sales office.

WITH THE  
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No. 10

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General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.  
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Anything and Everything for GAS WELDING or CUTTING and ARC WELDING

supplied for those who desire a ready-mixed oil for these operations. This oil is also used for chambering operations.

For honing, Houghton's Gun Barrel Honing Oil provides the necessary high finish and longer stone life. Faster speeds with longer tool life and the requisite fine finish are assured by the use of these special cutting oils for gun barrel machining.

**General Engineering Handbook.** Charles Edward O'Rourke, Editor-in-Chief. Second Edition. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. 1,120 pages, 800 illustrations, 292 tables. Bound in cloth. Price, \$4.00.

This book gives the fundamental engineering data for which all engineers and architects have constant use, being carefully selected, logically arranged, and clearly presented by 26 specialists representing all divisions of the engineering profession.

The civil engineer will find seven sections of this compact handbook dealing

with his branch alone; he will also find the mechanical engineering data he needs in three other large sections. He will find two sections that give him the electrical engineering information he needs. Similarly, the mechanical engineer and the electrical engineer will find not only the essentials of their own fields carefully and usefully presented but the essentials of allied fields as well. Six sections give fundamental material of importance to all engineers.

To facilitate the all-around use of this handbook, particularly by engineers desiring information outside their own special field, general descriptive material, highly specialized material, and so on is omitted in favor of specific facts and definite methods, presented in such way as to require the exercise of a minimum of judgment on the part of the user.

Thus, in the second edition material such as that on water power plants, electric power equipment, and so on has been eliminated and many new fundamental data added. Although containing 11 fewer sections than the first edition, the second edition actually contains over 200 more pages, with all material revised and brought up to date.

# **SHEAR-CUT**

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**Here's a complete line of  
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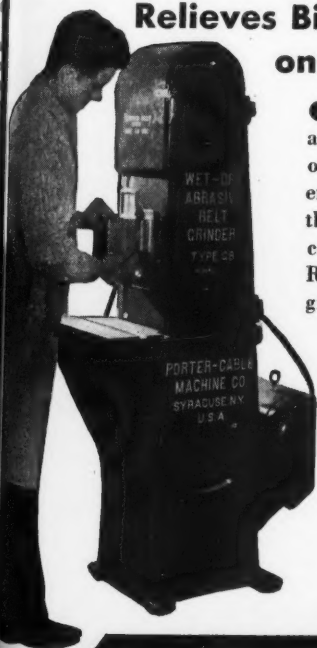
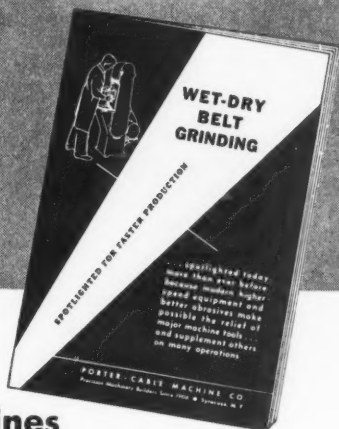
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**Tells how**  
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**Relieves Big Machines**

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## Crisis

OUR United States is, at this moment, faced with the greatest danger with which it has been confronted in its entire history. One by one the nations of Europe have been overrun and brought to their knees by a conqueror who has openly proclaimed his intention to bend the nations of the Earth to his will. Only one that he has attacked is still fighting for its freedom—and that one is Great Britain.

Realizing the danger that becomes more real with the fall of each nation in turn, large or small, our government has begun in earnest the task of rearming our forces while, at the same time, trying to maintain a supply line to England in the hope that England will be able to hold out until we can supply enough arms of all kinds to be really effective. This we must do, for if England falls, America will be faced on both sides with enemies who will, by taking over the resources and workers of the conquered countries, be continually growing stronger.

It is well known that the German nation was completely equipped and ready when it invaded Poland. It is also well known that Great Britain was badly equipped, and certainly no match for the efficient German military machine. Furthermore, nine months later the British lost the larger part of what equipment they did have at Dunkirk. So what the British were up against, after the summer of 1940, was the necessity of straining every nerve and sinew to try

to build up their defenses to a point equal to the condition of the German defenses when the war began.

In the meantime Germany was extending its conquest over most of Europe, taking over, one by one, the workshops of the conquered nations—France, Czechoslovakia, Poland, Norway, Holland, Belgium, and lately Yugoslavia and Greece. Desperately behind in the race and forced to expand her industries amid an incessant rain of bombs, Britain has been under the added necessity of trying to match the enormous advantage which Hitler has obtained through his conquest of the continent.

That is why the outcome of this war—and with it the decision as to what kind of world this is going to be for generations to come—is up to America. Britain could not possibly cope with those ever-expanding odds without our help. And Britain and the United States together cannot cope with them unless we expand every productive effort to the utmost and work with a singleness of purpose and determination that we have never yet had to display.

But we cannot hope to meet the needs of the hour—we cannot hope to produce the tanks, and guns, and airplanes, and fighting craft—with a large part of our defense workers continually striking for increases in pay, union recognition, and what not. Practically speaking, the sons of American fathers are preparing to go into battle from which they may not return, equipped with empty guns because their fathers and uncles and neighbors are on strike for ten cents more an hour.

If the American workman can't understand what this means; if he is unable to realize the character of the danger that confronts this nation; if a few more cents an hour or the recognition of his union are of more importance than the safety and freedom of his country, perhaps he needs a dictator after all. Let's use some horse-sense before we make asses of ourselves.



# SELECTIVE SPEEDS AT *your* COMMAND

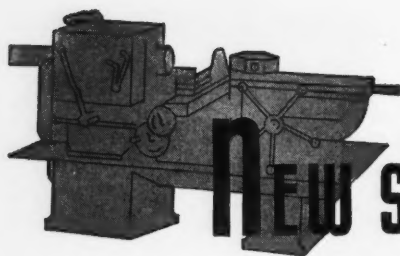
A large, dark industrial machine, possibly a lathe or mill, is shown in profile. A hand is visible on the right side, adjusting a control lever or handle. The machine has various gears, belts, and a large flywheel. The background is dark and moody, with some light reflecting off the machine's surfaces.

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or any other type machine requiring selective speeds.  
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LIMA, OHIO *Builders of Industrial Motors* U. S. A.



# NEW SHOP EQUIPMENT

## Denison 400-Ton Hydraulic Press

A 400-ton hydraulic press having a C-frame which incorporates the main ram, rapid traverse cylinder, and a stripper cylinder operating through the bolster has been brought out by The Denison Engineering Co., Chestnut and Water Sts., Columbus, Ohio. The oil reservoir, hydraulic pump and motor, motor starter, electrical controls, and control valves are all assembled within the open or C-type frame. The frame is constructed

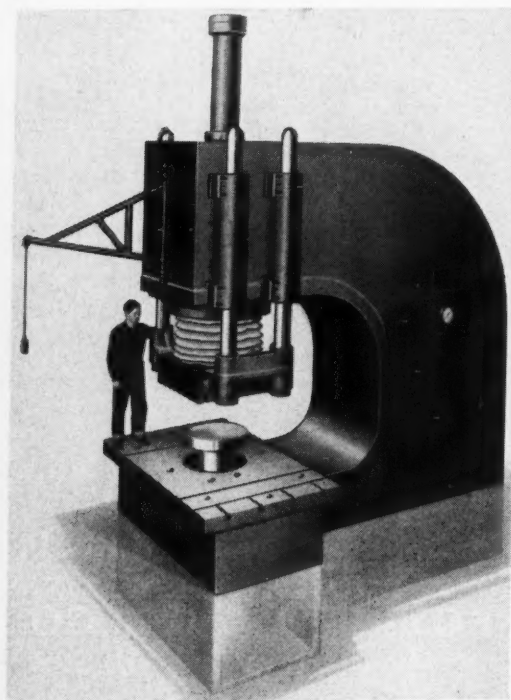
entirely of welded steel plate, thoroughly annealed and normalized after welding. To obtain the proper working height for the bolster, the press, when installed, extends below the floor level.

The main press cylinder has a capacity of 400 tons and a stroke of 30 in. It is single-acting and has a 36 x 36-in. platen provided with T-slots for affixing tools. Two guide rams operating in bronze-lined bearings are attached to each side of the press frame to prevent the main ram from rotating.

The rapid traverse or pull-back cylinder is double-acting and is flange mounted on the main press cylinder. It has the same stroke and working pressure as the main cylinder, and is provided with a down-speed of 6 ft. per min. and an up-speed of 10 ft. per minute.

The hydraulic stripper cylinder is double-acting and is flange mounted to the sub-bolster in the lower part of the press frame. An easily removable packing gland at the top of the stripper cylinder fits flush with the bolster so as not to interfere with work on the bolster. The upper end of the stripper cylinder ram is machined to permit easy attachment of bending tools or dies. The stripper ram is protected by a steel cover when not in use.

The bolster is machined to accommodate the stripper cylinder and is machine-fin-



Denison 400-Ton Hydraulic Press

ashed all over. It is provided with T-slots for affixing tools and has a horizontal surface of 60 x 96 inches.

A pendant-type control station on a swinging bracket extending from the front of the press has push-button control for the main ram, for rapid traverse speed down, for slow speed down, and for reversing the ram. The stripper cylinder is operated from either of two push-button stations located on opposite sides of the press frame. All cylinder and ram operations and their controls are coordinated and provided with safety arrangements to give full protection at all times against damage, either to the press or to the work.

The design of the Denison 400-Ton Hydraulic Press allows for ready modification to a wide variety of pressing operations.

### Colonial Improved Horizontal Broaching Machine

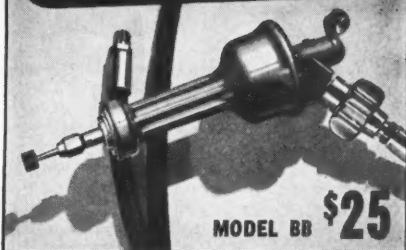
According to an announcement made by the Colonial Broach Co., 147 Jos. Campau, Detroit, Mich., numerous new features and improvements are included in the complete standard line of universal horizontal broaching machines now being marketed by this firm. The standard machines range in capacity from 3 tons and 36-in. stroke to 25 tons and 90-in. stroke, with larger capacities also available on special order.

In these improved broaching machines, the peak capacities have been substantially increased over the normal ratings. The new peak capacities are said to provide greater reserve power and smoother operation when tooling is adapted for the normal capacities of the machines.

Two important features of the Colonial Improved Horizontal Broaching Machine include a shock-proof control mechanism to prevent impact of the starting lever at each end of the stroke and a readily accessible and increased vertical adjustment for the drive head to provide greater flexibility for off-center special broaching setups. Provision for convenient mounting of spiral broach drive heads has been maintained, thereby adapting the machine to spiral broaching setups.

Constructional improvements are numerous. The cylinders are of steel tube construction with welded joints to ensure against leaks and to provide longer

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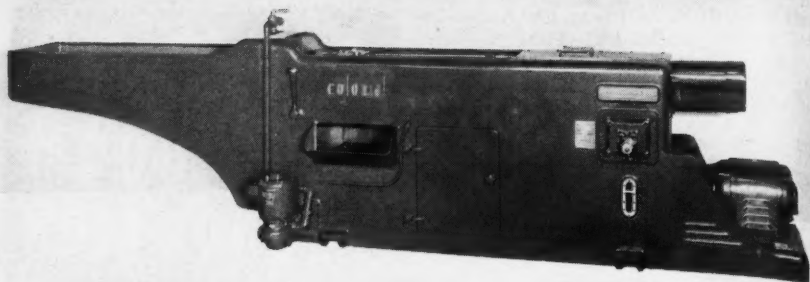
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Company.....

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**MADISON-KIPP CORPORATION**

208 WAUBESA ST., MADISON, WIS., U. S. A.



Colonial Improved Horizontal Broaching Machine

life. Valves and piping have been simplified to facilitate accessibility for service and maintenance. An integral motor and pump bracket assures correct alignment between these parts, thus preventing wear and providing longer life with quiet operation. A rigidly constructed chip pan is provided which can be used as a broach follow rest support when required. The chip compartment is readily accessible for chip removal. Due to the simplified piping, additional reserve space is available within the machine for storage of tools, pullers, adapters, and so on.

The main frame is of welded steel construction, steel castings being used wherever necessary to strengthen parts where excessive strain is applied, such as faceplate, cylinder mounting, and so on. The frame is designed so that it completely encloses the operating mechanism of the machine.

The machine face is of sufficient area to support and attach surface broach fixtures, and is provided with an extremely large hole to permit maximum broach capacity. The face has two keyways located centrally with the hole and

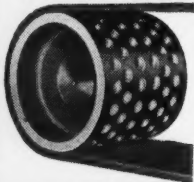
90 deg. to each other, thus providing a positive and accurate locating position for fixtures. The crosshead has replaceable hard bronze shoes which ride on hardened and ground ways and are provided with a means for lubrication to ensure long life. Both crosshead and pullhead have identification marks to indicate when pullers are adjusted centrally with the keyways on the face of the machine.

A hydraulic tank of ample capacity is provided for operating the Colonial Improved Horizontal Broaching Machine. An oil level gage mounted on the side of the machine indicates the available supply of hydraulic oil. The coolant pump of the machine is of the heavy duty, large volume type.

### DoAll Precision Surface Grinder

Illustrated herewith is the spindle head of the DoAll Precision Surface Grinder now being marketed by Continental Machines, Inc., 1306 S. Washington Ave., Minneapolis, Minn. Super pre-

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Stock most Std. Sizes to 16" Dia.  
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Prices Below

Dia. Face Price	Dia. Face Price
2 "x2 1/2"—\$1.25	4 "x3 1/2"—\$2.85
2 1/2 "x2 1/2"—1.45	4 1/2 "x5 1/2"—3.95
3 "x3 1/2"—2.25	5 "x4 1/2"—4.25
3 1/2 "x3 1/2"—2.55	6 "x5"—4.75

We Supply Fractional Dia. and Face Pulleys—From Large Casting Stock.

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Increase  
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## STRAIGHTENING SPLINE SHAFTS

**66% FASTER**  
Production increased from 60 to 100 per hour when this operation was put on an 8-ton G-F-P Press.

## PRESSING LININGS INTO PUMP CYLINDERS

**50% FASTER**

Production rate increased 50% when job was put on a 20-ton G-F-P Press.

## BURNISHING SPLINED HOLES

**122% FASTER**

When the operation of burnishing splined holes in sprockets was put on a 20-ton G-F-P Press, the production rate increased from 90 to 200 per hour.

Get in touch with the nearest office for information regarding the application of G-F-P Presses to your production problems.

## GENERAL MANUFACTURING COMPANY

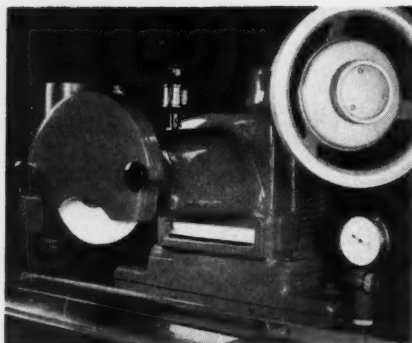
6432 FARNSWORTH AVE., DETROIT, MICHIGAN

Chicago—John Morley Davie—4125 Belle Plaine Ave. • Cincinnati—George H. Diers—4807 Yarmouth Place • Cleveland—The Cleveland Duplex Machinery Co., Inc., Penton Bldg. • Detroit—McKee-Kenyon & Co.—1627 W. Fort St. • New York—Triplex Machine Tool Corp.—125 Barclay St.

GENERAL

*Flexible*

POWER PRESS



Spindle Head of DoAll Precision Surface Grinder

cision ball bearings carried in a ground, heat-treated, forged, SAE 3140 quill make up the "heart" of the spindle head assembly. The lapped spindle hole through the spindle head is said to assure a perfect fit.

Included in the spindle head assembly are such features as built-in flush-type lighting directed to where it is needed, a dial indicator giving direct measure-

ment between wheel and work in tenths and an adjustable dust or splash guard which can be set close to the work and adjusted as the wheel wears.

The wheel guard rotates and can be locked in any position when using a tangent-to-radius wheel dresser. The handwheel is graduated in half-thousandths and has an auxiliary vernier adjustment for feeding in tenths. The handwheel is finished in dull chrome with enamel filled graduations to assure against rust from perspiration or coolant. The dull chrome finish also provides an ideal surface for marking settings with a lead pencil.

### Sibley 25-In. Drill Press

A 25-in. swing all-gear driven machine for both toolroom and production work is announced by the Sibley Machine & Foundry Corp., South Bend, Ind. Features of the machine include rugged design and accurate operation.

Instant change of feeds and speeds is effected by cam-operated levers located within easy reach of the operator. Spindle speeds range from 75 to 1,500.

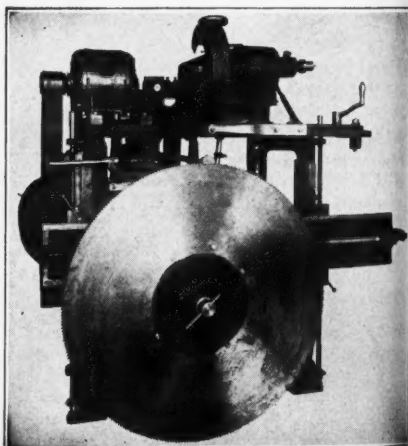
## THE COVEL HANCHETT No. 146 84" CAPACITY SAW SHARPENER

FOR FULL AUTOMATIC  
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SAWS FROM . . . . .  
36" TO 84"

A full line of automatic  
Sharpeners for all saws  
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SAW and KNIFE FITTING  
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**COVEL HANCHETT CO.**  
Big Rapids, Mich., Portland, Ore.



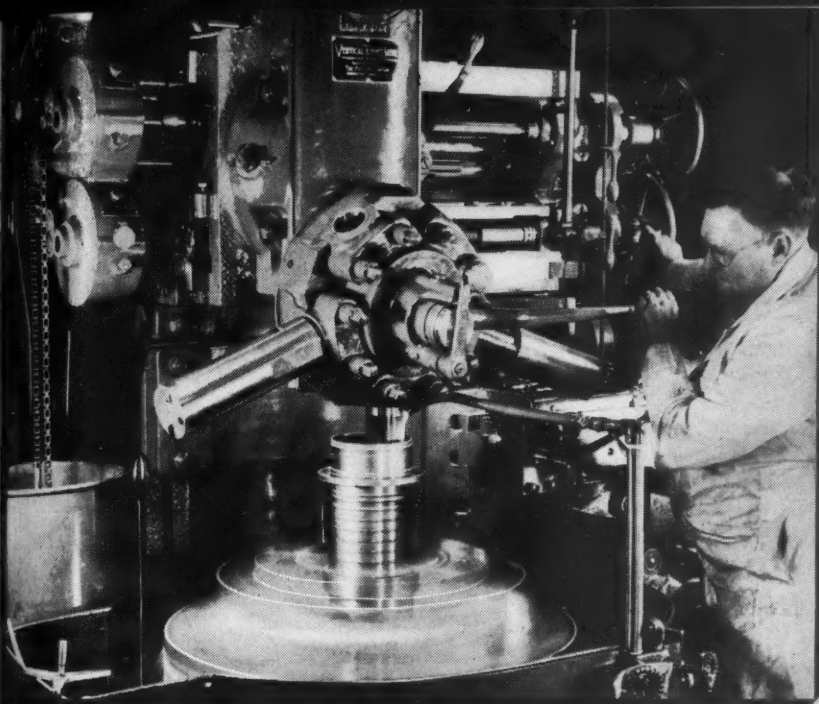


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## *Just the Job for a* **V.T.L.**

Packard uses a Bullard Vertical Turret Lathe to face combustion chambers on their 1,350 H.P. marine engines when required. The turret tools and the side tools cut simultaneously, thus saving time **ON** cuts — and **BETWEEN** cuts.

If you have a national defense contract that requires high production and sustained accuracy, the chances are that a V.T.L. will handle your job better, faster, easier. Profit from the experience of Packard and hundreds of others — get the story on the Bullard V.T.Ls.



**BULLARD**

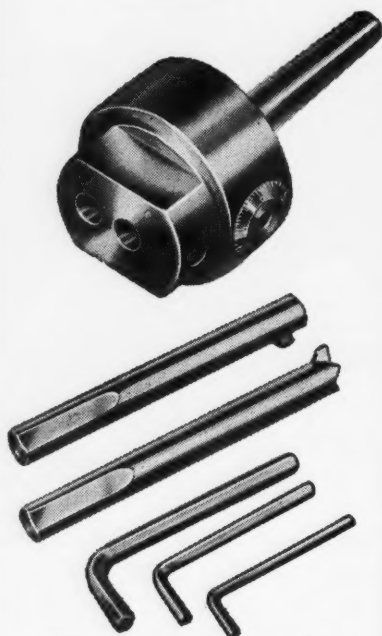


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MAKERS OF

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MILLING MACHINES

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MILLING ATTACHMENTS

GLENDAL, CALIFORNIA, U. S. A.

r.p.m. Feeds range from 0.005 to 0.045 in. The six-spined spindle can be operated either by power or hand feed; the travel by power is 12 in. and by hand, 12½ in. The spindle takes a No. 4 and



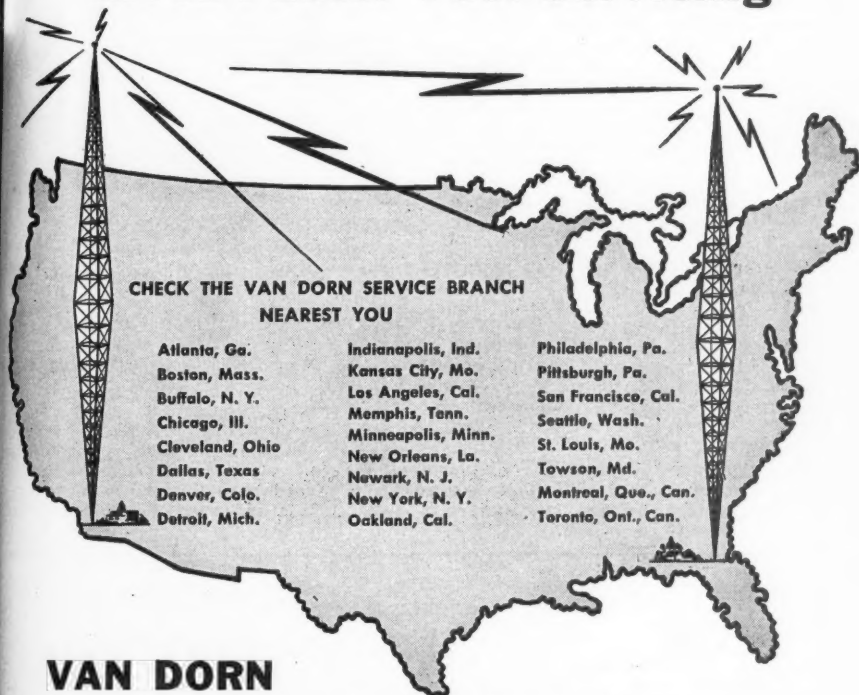
Sibley 25-lb. Drill Press

No. 5 Morse taper. All controls are conveniently located at the front of the machine so as to enable the operator to make frequent change-overs on job work, thus increasing the production rate.

The all-gear drive is obtained through a series of alloy steel, heat-treated gears mounted on horizontal shafts. The transmission is totally enclosed and is a complete, removable unit with the transmission shafts mounted

5 to 0.045  
be oper-  
feed; the  
by hand,  
No. 4 and

# This Coast-to-Coast Hook-Up Gives Faster Tool Servicing



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has 25 Company-Owned Service Branches that eliminate the usual "time out" while tools are sent back to the factory. Equipment is standardized in all Stations for most efficient and rapid work. Factory-trained personnel and genuine replacement parts. The *only* facilities of their kind in the portable electric tool industry. A good thing to remember—next time you're in the market for Electric Tools—Van Dorn Electric Tools—720 Joppa Road, Towson, Maryland.

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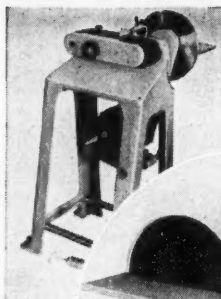
on anti-friction bearings. Multi-splined shafts are used throughout and all gears operate in a bath of oil, thus providing a smooth, powerful drive. Tapping operations are controlled by electrical reversing switches operating through a starting lever.

The Sibley 25-In. Drill Press has a overall height of 9 ft. 6 in. Maximum distance of spindle to base is 33 in. The working surface of the table is 18½ x 24 inches.

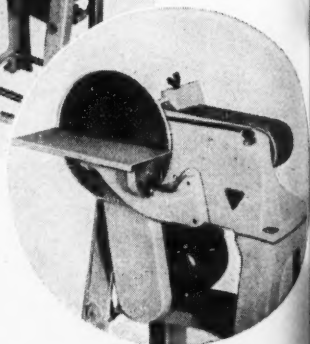
### Duplex-M Abrasive Band and Disc Grinder

A streamline, power-driven abrasive band and disc grinder designated as the Duplex-M has been placed on the market by the Walls Sales Corp., 96 Warren St., New York, N. Y. The grinder is furnished complete with heavy duty ½ h.p. motor, fully enclosed V-belt drive, balanced steel pulleys, dustproof ball bearings, Alemite lubricating system, and grease gun.

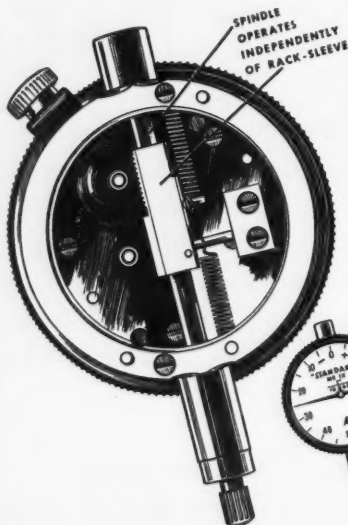
The motor is mounted on a table between the frame legs. A simple screw adjustment is provided for taking up



Duplex - M Abrasive Band and Disc Grinder



slack in the V-belt. A handle-type eccentric tension release permits belt changing, while an improved single action thumbscrew is said to assure perfect belt alignment. The bevel attach



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*are sturdy and long lasting:*

- A positively shockproof design
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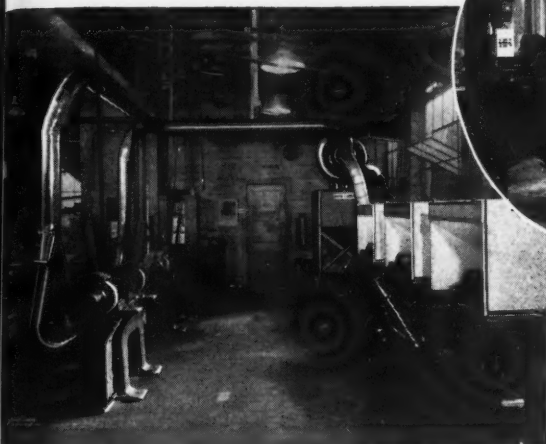
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**Standard Gage Co., Inc.**  
75 Parker Ave.  
POUGHKEEPSIE, N. Y.

- M Abr  
3 and  
Grinder

# *Dust* FROM ALL TYPES OF GRINDING OPERATIONS *effectively handled* BY **ROTO-CLONE**

Below — A Type-D Roto-Clone exhausting grinding wheels and specially designed hoods for the control of dust from portable grinders.



Roto-Clone is equally effective for all types of metal grinding service, from rough snagging and casting cleaning to the finest finish grinding in the production of precision equipment.

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THE SUCCESS of Roto-Clone dust control for grinding operations is indicated by more than 2,000 installations in this service—almost half of which are repeat orders. One company now has 51, another 60, and still another has 73 Type D Roto-Clones on metal grinding operations.

Roto-Clone offers the exclusive advantages of economy of space and piping combined with low power consumption and high efficiency in dust separation. There is a size for every requirement. Write for Bulletin No. 272.

**AMERICAN AIR FILTER CO., INC.**

*Incorporated*

335 Central Avenue

Louisville, Kentucky

## **ROTO-CLONE** *DUST CONTROL SYSTEMS*

June, 1941

MODERN MACHINE SHOP 209

ment shown on the grinder is adjustable to any angle close to the grinding table.

The Duplex-M Grinder is equipped with a steel disc which is removable together with a disc grinding table that is adjustable and of ample size for practical purposes. The design of the machine permits rough grinding to be performed on the abrasive disc and finishing operations on the abrasive band.

Specifications of the Duplex-M Abrasive Band and Disc Grinder are as follows: band grinding table, 5 x 10¼ in.; disc grinding table, 6 x 12 in.; abrasive

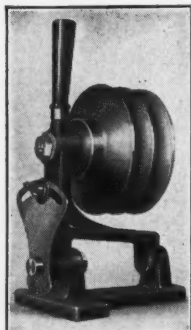
band, 4 x 36¼ in.; disc, 12 in. diameter drums, 4 x 4½ in.; speed, 1,450 r.p.m.; motor, ½ h.p.; floor space, 20 x 24 in.; weight, 300 pounds.

## Motch & Merryweather Saw Grinder

The Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland, Ohio has developed an automatic saw grinder for sharpening segmental saw blades used in connection with its No. 3 and No. 4 hydraulic cold sawing machines. Designated as the No. 1, the grinder is rigidly constructed and is provided with automatic indexing to assure rapid, accurate sharpening.

Drive is obtained by means of a single electric motor through belts. The drive is completely enclosed and protected against the entrance of dust. An oil pump provides lubricant to all internal moving parts. A wheel spindle and wheel slide are located in the same plane, thus eliminating overhang and minimizing vibration. Accurate pitch is effected by an indexing disc. Fast speed for fine pitches and small diameter saws and slow speed for larger saws are obtained through sliding gears. Alternate high and low teeth can be ground in one setting by merely positioning a lever on the left-hand side of the machine. All operating controls can be actuated while the grinder is in operation.

The segmental type saw blades for which the No. 1 grinder is designed are also manufactured by The Motch & Merryweather Machinery Co. The tooth pitch of these saws can be suited to any material, thus contributing to speed and accuracy. Segments are of high grade tool steel and are fitted to a heat-treated center. They project slightly to



## TOLEDO Variable Speed Transmissions

For variable speed control of V Belt driven equipment.

Low in Cost... Easy to Install... Convenient Size... Simple to Operate... No Belts to Shift... Infinite Speed Selection in Stepless Speed changes.

Types 1A and 2A Provide up to 3 to 1 Ratio with Power Ratings from Fractional to 4 H.P.

Other Types Available to Provide Speed Changes up to 10 to 1 Ratio.

All Types Available Either in Complete Assembly or Wheel Assembly Only.

If you have a variable speed requirement it will pay you to investigate these devices.

Write for literature and quotations.

**THE TOLEDO TIMER CO.**  
2224 ALBION ST. TOLEDO, OHIO

## THOR STAMPS

These correctly heated alloy steel stamps give you more marks per dollar.

Central striking point assures even indentation. Thumb side-marking makes them easily read... easily used.

Write for catalog.



**The Pittsburgh Stamp Co.**  
812 CANAL ST. PITTSBURGH, PA.



**HIGH QUALITY**

**plus intelligent comprehension  
of your requirements make**



**COOLANT PUMPS  
BY-PASS RELIEF VALVES**

**AN OVERWHELMING FAVORITE**

**W**HATEVER the purpose . . . wherever the  
need FULFLO PRODUCTS step up the  
efficiency and productiveness of the equip-  
ment with which used.

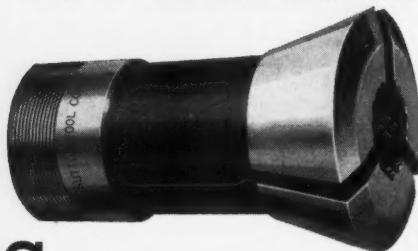
**THE**

***All inquiries handled promptly***



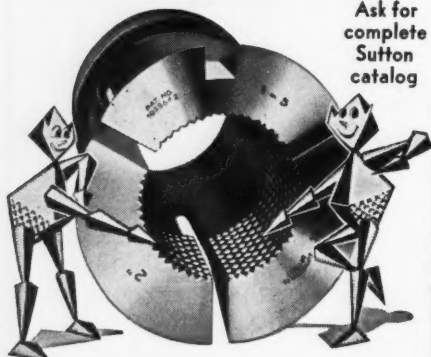
**Specialties Co., Inc.**  
**BLANCHESTER, OHIO**

## For Each Make and Size of Screw Machine



**S**UTTON DIAMOND-GRIP Collets are expertly designed and accurately machined to suit the specifications of each make and size of screw machine. They all have Sutton diamond serrations that grip tighter under less tension. Only Sutton Collets are diamond-serrated.

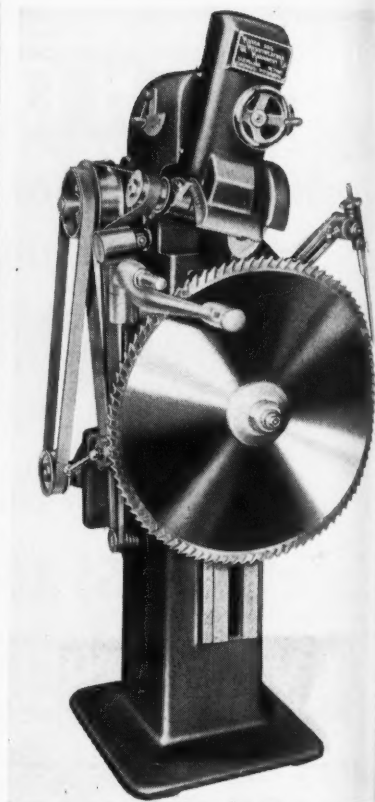
## Sutton DIAMOND-GRIP Collets



Ask for  
complete  
Sutton  
catalog

## SUTTON TOOL COMPANY

2895 W. Grand Blvd. • Detroit, Mich.  
Accessories for Screw Machines



Motch & Merryweather Saw Grinder

protect the body of the blade from rubbing. The teeth are ground to a special form to provide the most favorable cutting conditions.

After the segmental teeth have become completely worn, the main blade can be reset with new segments without any reduction in diameter. The segments are machined to gauge and can be readily interchanged.

## Brush Surface Analyzer

An instrument for recording surface quality of bearings, pistons, pins, shafts, cylinder walls, and so on, after grinding, honing, lapping, and superfinishing operations has been brought out



## "INTEREST" ON YOUR INVESTMENT...

To be sure your new, high-speed, high-production equipment will repay you for its installation, give your operators the benefit of highest quality cutting tools at the workhead, where production is determined.

# MORSE

**THERE IS A  
DIFFERENCE**

**TWIST DRILL AND  
MACHINE COMPANY**

**NEW BEDFORD, MASS., U. S. A.**

**NEW YORK STORE: 130 LAFAYETTE ST. - CHICAGO STORE: 570 WEST RANDOLPH ST.**

MODERN MACHINE SHOP 213

June, 1941



Brush Surface Analyzer

by The Brush Development Co., 3311 Perkins Ave., Cleveland, Ohio. Designated as the Brush Surface Analyzer, the unit consists of an analyzer head, amplifier, and direct inking oscillograph. A surface plate for setting up small parts is also supplied. The analyzer head is normally furnished with a pick-up arm capable of making accurate measurements of finishes produced by ordinary production methods. Addition-

volt, 60 cycle power supply. It is ruggedly constructed and easily portable in the carrying case in which it may be operated.

al accessories for increasing the utility of the analyzer are also available.

The Brush Surface Analyzer employs a tracer method of recording. In use, the surface under test is explored by a fine diamond point, the vertical motion of which is amplified up to 60,000 times in a corresponding pen motion on a moving paper chart. The analyzer can be readily set up in the shop or laboratory for production or research by simply plugging into a 110

### Upton Salt Bath Furnace

Based on a design which is described as the "Electrothermic - Permeation" principle, the Upton Electric Furnace

## WICAGO INTERNAL PRECISION GRINDING MACHINE

These machines are a flexible and profitable addition to any toolroom, assuring years of accurate and trouble free operation. The model illustrated is equipped with motor-generator (Extra Equipment) for D.C. operation. For over 15 years, in our own and other plants, these machines have proved their extreme accuracy and economical production capacity working to very close tolerances.

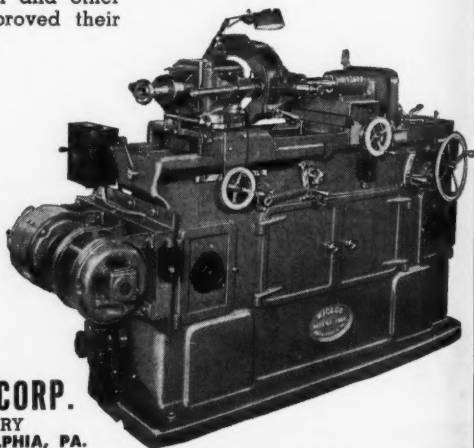
#### FEATURES:

1. Vibrationless underslung drive.
2. Rigid work-head.
3. Automatic Carriage reverse.
4. Positive stop for blind hole grinding graduated to .001.

PROMPT DELIVERIES

**THE WICAGO MACHINE CORP.**

EST. 1868 — 73rd ANNIVERSARY  
WAYNE JUNCTION PHILADELPHIA, PA.



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ne, 1941

The correct  
oil film  
to each  
individual  
bearing...  
*automatically*

"CLEVELAND" Automatic Screw Machine with Bijur automatic  
lubrication of spindle, turret and cross-slide bearings . . .

## For speed AND ruggedness

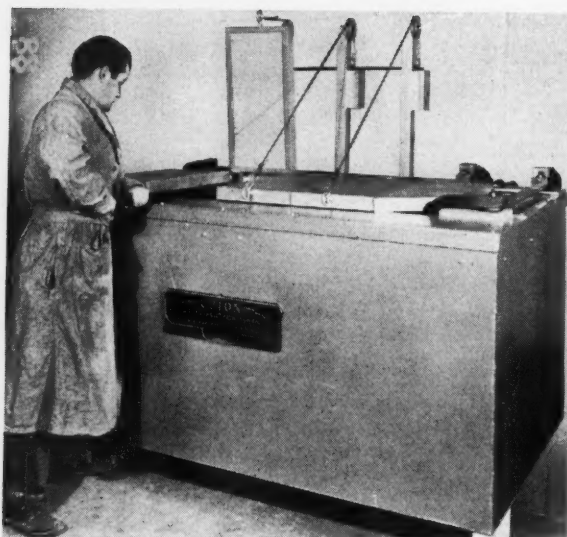
● Whatever the bearing surface, its location or lubrication need, BIJUR maintains the correct, metered oil film—automatically. Any number or combination of bearings—any type of machine! For high production maintained over long periods . . . Bijur built-in lubrication.

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, N. Y.

1329

# BIJUR

AUTOMATICALLY *Correct* LUBRICATION



Improved type of furnace designed and manufactured by Upton Electric Furnace Co. for any liquid heat-treating operation requiring a range of temperatures from 300 to 2,500 deg. F.

aluminum alloys, tool tipping, and so on, in a range of sizes suitable for either batch or continuous operation.

Advantages claimed for the improved new design are: greater efficiency due to generation and distribution of heating throughout the entire pot with larger percentage of heat developed at the bottom, elimination of "super heated" spots which destroy chemical balance of bath, spacing of electrodes to prevent possibility of "shorting" and burning the work, and 20 per cent greater working area.

Co., 2211 Grand River, Detroit, Mich., has placed on the market a line of electric salt bath furnaces. The Upton Furnace is reported capable of producing uniform heat, reducing fuel costs, and eliminating excessive spoilage of carburizing salts. Features include a ceramic pot which can be guaranteed for at least one year's operation.

Range of operation available with the furnaces includes virtually any heating operation requiring temperatures of from 300 to 2,500 deg. F., and the "proving" period for the furnaces is said to have covered almost every classification of temperature, composition, and size of work. The furnaces are available for carburizing, cyaniding, hardening, brazing, heating for forging, treating

bility of "shorting" and burning the work, and 20 per cent greater working area.

The heat for the bath is generated throughout all the effective working space rather than in a confined, separate heating area. Distribution of current flow for heating the salt is obtained by means of an arrangement of the electrodes in a manner such that the greatest heat is generated at the bottom of the pot, with the balance decreasing in intensity as it approaches the surface of the liquid.

The electrodes are installed outside the normal working area in opposite corners but are so inclined that their lower ends tend to converge. The resulting concentration of current gener-

## SAVE TIME on DEFENSE WORK

Convert your present lathe into a Turret Lathe in 15 seconds by attaching this Turret to the Tailstock Spindle of your engine lathe. Five tools automatically center when brought into play. Four sizes.

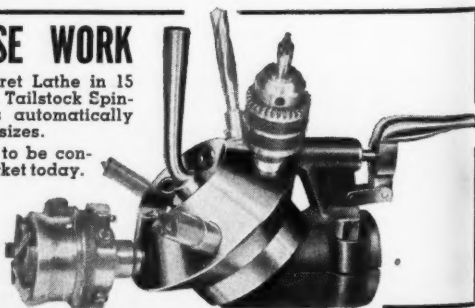
This is a well made precision tool not to be confused with smaller "gadgets" on the market today.

IMMEDIATE DELIVERY

Free bulletins on our other time saving tools are awaiting your request.

**Jefferson Machine Tool Co.**

750 W. Fourth St. Cincinnati, Ohio





# NO "BOTTLE NECKS"

*Here is a brand new tool which will cut down set-up time and help speed up your production.*



## ALCO RELEASING MODEL TAP HOLDER

Production is at a standstill while your hand screw machines and turret lathes are being set up for a job. Any saving in set-up time means more production hours per machine.

Since ALCO Tap Holders hold taps firmly *without the use of bushings*, no time is lost in making or searching for bushings. Just insert the tap, tighten the nut, and GO!

The most rigid drive ever used on a releasing type tap holder which can cut either right hand or left hand threads without any adjustments whatsoever. The elimination of pins in the drive results in greater rigidity — another step toward better production.

**Write for catalog and further details.**

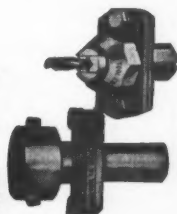
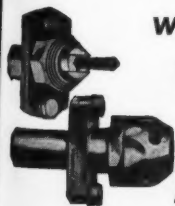
**THE ALCO TOOL COMPANY**

835 Housatonic Ave.,

Bridgeport, Conn.

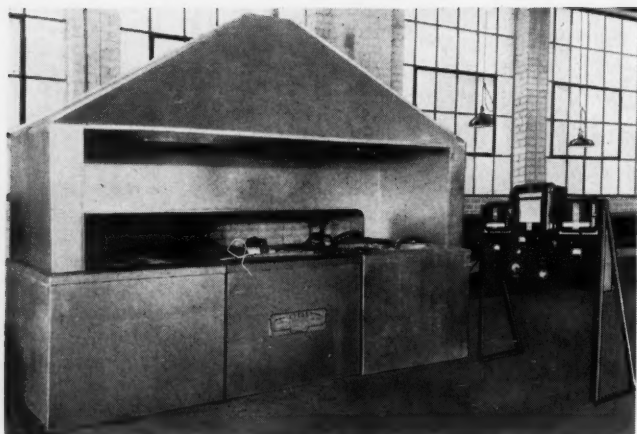
Detroit Office: 908 Stephenson Bldg.

**ALCO TOOLS**



MODERN MACHINE SHOP 217

June, 1941



Typical new Upton  
"High-Speed-Steel"  
Furnace consisting of  
preheat, high heat  
and quench with cer-  
amic brick lined pots

The drawing shows how approximately 80 per cent of the heat is generated at the bottom of the pot where the electrode ends are close together with the balance of the heat being distributed upward and tapering off as it reaches the top. Wide electrode spacing eliminates

ates the greater amount of heat at the bottom of the pot, thus creating active thermal circulation throughout the entire bath. Overheating of the work itself does not occur because of the vast difference between the electrical resistance of any metallic part and the electrical resistance of salt.

inates the possibility of "super heated" areas, which hasten deterioration of carburizing salts especially, and ensures a more evenly distributed temperature.

An exclusive feature of the Upton Furnaces is the adoption of ceramic brick pots as standard. The company guarantees the bricks for one year, even

## IF YOU ARE FINDING HIGH SPEED STEEL IS HARD TO GET --

Remember, there IS something you can do that will help. The situation already is serious — and growing worse. Cobalt has disappeared from the market — tungsten is following fast. Against the day when deliveries may stop completely, why not:

- a) Send those high speed tools you make, and let us Nusite harden them.
- b) Tell your suppliers you want the tools they sell you Nusite treated.

Nusite gives greater hardness throughout, and double toughness. Your tools will not only do more work — but will LAST LOTS LONGER!

BETTER HARDENING — BETTER RESULTS.

### Perfection Tool & Metal Heat Treating Co.

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new Up  
Speed-Steel  
consisting  
high heat  
treatment  
with a  
nickel lined  
piston

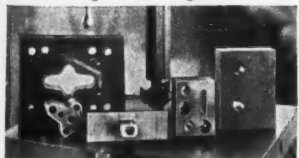
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# DoAll Works like Magic<sup>★</sup>

**AT GONDA  
ENGINEERING CO.  
SALEM, OHIO**



**8 HOUR JOB IN 1½**  
Drill Fixture cut from a solid piece  
in less than 1/5 former time. Note,  
slug is salvaged.



**20 HOURS' WORK IN 6**  
By former method of drilling, slot-  
ting, shaping and milling, these  
parts would have taken 20 hours.  
DoAll did it in 1/3 this time.

The parts shown above were cut in one eight-hour day on the DoAll. At least five days would have been required by drilling, shaping, milling and boring. The DoAll enables Gonda to make excellent deliveries to their customers; also releases the other machines for work more suited to them.

Today, every plant where metal is used, needs the DoAll Contour Machine to get work through on schedule.

One of our factory trained men will call at your plant to show you what a DoAll can save for you. Don't delay . . . Write today!



**FREE**—Literature and technical data on Contour Machining.

**CONTINENTAL MACHINES, INC.**  
1306 S. WASHINGTON AVE. MINNEAPOLIS, MINN.

Associated with the DoAll Co., Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.

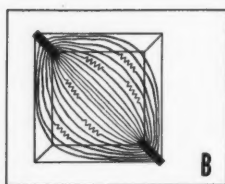
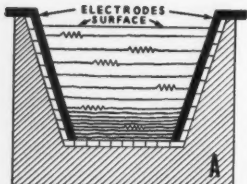
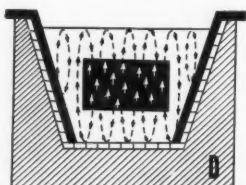
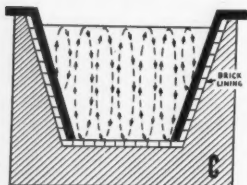
on high speed steel and similar work requiring extreme temperatures.

Two types of pots are furnished, a high temperature and low temperature

The low temperature pot, which is also guaranteed for at least one year of operation, follows the same general design but does not require the special alloy lining.

Both types of pots are built with the walls at such an angle as to best withstand the effects of expansion and contraction due to the range of temperatures involved.

Temperature control of the indicating or recording type are of standard makes and are available in several different models to suit individual requirements. Water cooled electrode bus bars and connectors increase efficiency by providing better conductivity.



(A) Distribution of current. Maximum at electrode ends and diminishing toward the top of the pot as electrodes incline outward. (B) Distribution of current covers entire area of pot. (C) Flow of heated salt is natural, does not "buck" normal thermal convection. (D) Generation of heat in every portion of the bath—even among a basket of small, densely packed parts—is accomplished by the Upton "Electrothermic-Permeation" principle of operation.

type. The high temperature type has an inner lining of special alloy steel insulated on both sides, with the interior of the pot itself being lined with two kinds of ceramic brick to withstand abrasion, thermal shock, and corrosion respectively. The exterior of the pot assembly is welded plate.

market by The Acromark Corp., 251-253 N. Broad St., Elizabeth, N. J. The holder is made entirely of a shock resisting tool steel with the head drawn to prevent peening and mushrooming. The thumb clip that holds the type is also made of steel and formed to hold the type by its oversize shoulder.

### "Hercules" Type Holder

Designed to withstand continuous hammer blows sufficient to mark steel parts and castings, a hand style heavy duty type holder, to be known as the "Hercules," has been placed on the

## ANDERSON HAND SCRAPER and BLADES



One blade is equal to an ordinary hand scraper reforged about 5 times. When it is worn out a new blade makes a new scraper. Blades need stoning but no grinding. Blades are

$\frac{1}{8}$ " thick from end to end and of correct hardness. Three sizes:  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ".

Try these fast, cost-cutting tools.

Write for complete details.

**ANDERSON BROS. MFG. CO.**

1926 KISHWAUKEE STREET  
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THE REPUTATION OF

# Carrier WEATHERMAKERS

LEAVES NO ROOM FOR "DOUBTFUL SCREWS"



**For extra secure fastenings, Carrier Corporation  
uses only Parker-Kalon Self-tapping Screws**

Like thousands of other manufacturers, Carrier knows that it not only gets better assemblies but also saves money by using Parker-Kalon Self-tapping Screws. It has found that the Quality-Control routine established by the famous Parker-Kalon Laboratory guards against the "doubtful few"—those screws that look okay but increase assembly costs by failing to make satisfactory fastenings.

You'll get no "doubtful few" if you insist on Parker-Kalon Self-tapping Screws. These Screws work right and hold tight every time because they are

Quality-Controlled, and are made with the most modern equipment by a company with over 25 years' experience in Screw manufacture. Can you ask for any stronger guarantee of high quality?

Mail coupon for free samples to:  
Parker-Kalon Corporation  
198 Varick St., New York, N. Y.

*Quality-Controlled*

**TYPES, SIZES, HEAD-STYLES  
FOR EVERY  
SHEET METAL ASSEMBLY**



SEND FOR SAMPLES

**PARKER-KALON**  
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*Self-tapping Screws*

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Please send us Free Samples of Self-tapping Screws.

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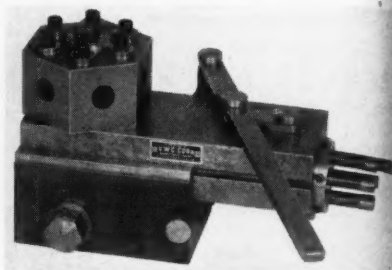
"Hercules" Type Holder

The type is made of a shock-resisting tool steel that is said to take an excellent hardness and retain its face. Each character is machine engraved and carefully hand finished and hardened. The extra body of the type not only gives it a shoulder for holding in position and ensuring foolproof assembly, but also provides great strength where needed, thus reducing replacements to a minimum.

The Hercules Type Holder is available in all commonly used sizes and can also be made to meet special applications such as marking in curved lines and on cylindrical surfaces. The holder is designed to withstand hard wear under high production conditions.

## C.W.C. Hexagon Bed Turret

Designed to step up lathe production to a rate comparable with hand screw machines, a hexagon bed turret for



C.W.C. Hexagon Bed Turret

bench and engine lathes has been announced by the C.W.C. Corporation, Hawthorn, Cal. Constructed to save time and labor while giving long, trouble-free service, the C.W.C. Hexagon Bed Turret is said to embody several unique automatic features. As the slide is drawn back the turret rotates

# ON GUARD *against* Production Loss with **PRODUCTIMETERS**



Electric Model S-D1-MF (left) is ceaselessly on the job, giving *accurate count* for economical, efficient production control. It's ideal for counting small pieces, parts that must not be marred, articles too light in weight for mechanical contact. *Especially* adapted for use with Photo-electric Relays.

**Full details in Catalog 16.  
Send for your copy today!**

There's a Productimeter for every industrial need. Write us for assistance on your counting problems.

## DURANT MFG. COMPANY

1932 N. Buffum St.  
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# SUPER TOOL CO.

21640 HOOVER RD.

DETROIT, MICH.



## CARBIDE TIPPED TOOLS

FOR TURNING - FACING - REAMING - SPOTFACING - BROACHING  
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GROOVING - COUNTERBORING - SHAVING - CENTERS - SPECIAL PURPOSES

June, 1941

MODERN MACHINE SHOP

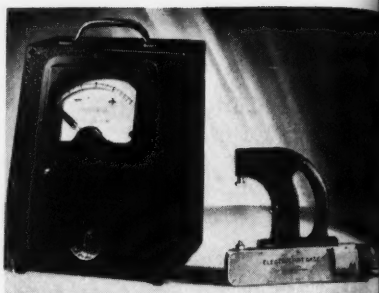
223

and is automatically locked in position by a tapered pin. The individual stops are automatically indexed with the turret. Where it is necessary to miss the next tool or a blank side on the turret, hand operation is recommended.

The slide is mounted on massive square surfaces to achieve maximum bearing, and ample adjustment is provided for wear. The turret is operated by hand lever and proper ratios of power are provided for each size of machine. The C.W.C. Hexagon Bed Turret is designed for use with the following: 10-in. South Bend, Sheldon, and similar lathes; 13 to 16-in. engine lathes, and the 9-in. South Bend Workshop lathe.

### P & W Electrolimit Snap Gage

A snap gage for use in all sorts of ways where fine inspection is required, to be known as the P & W Electrolimit Snap Gage, has been placed on the market by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn. According to the manufacturer, the gage brings accurate "tenth" measurements directly to the work in the ma-



P & W Electrolimit Snap Gage

chine, and is light and easy to handle. In addition, the electric circuit of the gage magnifies any errors into an easily read needle movement on a dial.

The P & W Electrolimit Snap Gage is available in two gage bodies and several sizes of frames for each body. By using the right combination, the gage can be arranged for dimensions from  $\frac{1}{2}$  up to 6 in. The two smallest frames have  $\frac{1}{4}$ -in. adjustment and all others have  $\frac{1}{2}$ -in. adjustment. Where several diameters are to be checked, and conditions are



*Are Coolant Pumps Your*  
**BOTTLENECK?**

*... Buy BRADY - PENROD*

Keep production high with BRADY-PENROD Coolant and Circulatory Pumps - motor driven, open impeller, centrifugal type. If you get poor results from standard pumps, let us produce the special type you need for volume business. Our pumps have hydraulic efficiency as high as 70%. They are designed to eliminate wear on the pump; reliable for use with abrasives. Equal efficiency maintained, pumping water or light oil. All five models available with separate rating established at 400 SSU; 750 SSU; 1250 SSU; 2000 SSU.

**$\frac{1}{4}$ H.P. MOTOR REPLACES  $\frac{1}{4}$ H.P.** - through superior pump design. All motors have 20% <sup>sur</sup>plus power.

**CAPACITIES:**  $\frac{1}{2}$ " to 2" pipe; 4 to 100 gallons per minute. Special models for larger capacities. Pressure up to 100 feet head.

**FREE** Send for Bulletin N-B541.

**BRADY - PENROD, INC.**  
MUNCIE, INDIANA.

# New Tapping Head Quickly Pays for Itself

**New "Proconier" High Speed Tapping Head Features Increased Output, Less Tap Breakage and More Accurate Tapping . . .**

In gruelling tests on actual production work—this remarkable new High-Speed Tapping Head with the exclusive, "Tru-Grip" Tap Holder has broken numerous plant records for speed of tapping, accuracy and elimination of tap breakage. There are definite reasons for this: The Tru-Grip Tap Holder is so compact and light (weighs  $\frac{1}{2}$  of conventional tap holders) that fly wheel effect is reduced to a minimum. The Tapping Head offers dry, double cone friction clutch that won't wear, can't absorb oil and makes bottom tapping easy — three-point balanced heat-treated gear reversing mechanism that distributes pull and greatly reduces strain — and many other important features. Find out how this tapping head can quickly pay for itself in your shop — and solve your tapping problems!

## SEND FOR BULLETIN

giving full details, description and prices on complete line of Proconier Precision Tapping Heads to meet all needs, the new Tru-Grip Tap Holder—and also the full line of Proconier Universal Tapping Machines, hand, foot or air-operated.

Proconier Safety Chuck Co.,  
12 S. Clinton St., Chicago, Ill.

Send me Bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name

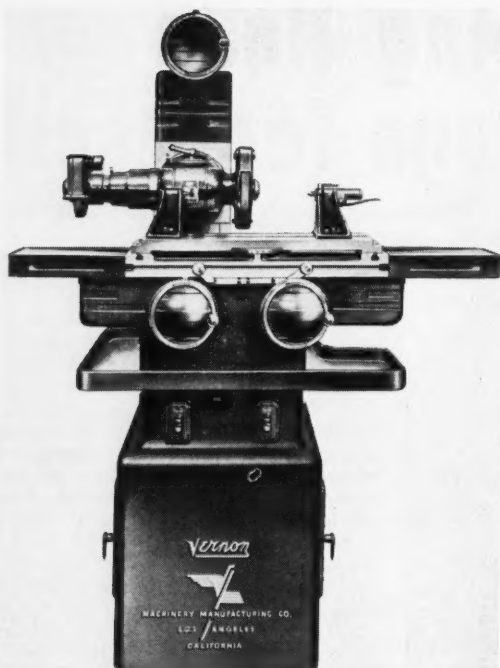
Address

City  State

# PROCUNIER

**SAFETY CHUCK CO. 12 S. CLINTON ST. CHICAGO • ILLINOIS**





favorable, a portable cabinet as well as selector switch and connections for several gage heads can be furnished.

### Vernon Combination Universal Tool, Cutter, and Surface Grinder

A combination universal grinder for all types of tool, cutter, and reamer grinding, internal and external as well

### Vernon Combination Universal Tool, Cutter, and Surface Grinder

as surface grinding has been added to the Vernon line of machines built by the Machinery Mfg. Co., Dept. MMS 441, 1915 E. 51st St., Vernon, Los Angeles, Cal. The motor which carries the grinding wheel swivels through 350 deg. vertically and the column on which the motor is mounted swivels through 350 deg. horizontally. Many important advantages are said to be afforded by this arrangement. For example, the center of the motor and column are positioned to align either cylindrical or surface grinding wheels with the center of the bed, thus providing a full grinding range without elongation of the ways.

When used as a surface grinder, the machine accommodates a 6 x 10-in. magnetic chuck and will grind a complete area of 6 x 16 x 7½ in. above the table. Extreme rigidity has been maintained in the surface grinder by making it an integral part of the machine.

The machine table is traversed by a two-speed handwheel and may be operated from either the front or rear of the machine. By tilting the motor and swiveling the column, Carboloy tools can be ground on the machine. Provision is also made for the use of a coolant pump so that the machine can be used as both a wet cylindrical and surface grinder if desired.

The Vernon Combination Universal Tool, Cutter, and Surface Grinder is

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VARIOUS WIDTHS  
and GAUGES

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CONTINUOUS LENGTHS

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4541 W. LAKE STREET HARDWARE DIVISION

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## KELLY SHAPERS SIGNIFY



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## PROFITABLE INVESTMENT

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**General Engineering & Mfg. Co.**

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**will do the  
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This Pot-Hardening Furnace consumes considerably less gas than ordinary units require, yet produces quick, high and accurate temperatures. Ideal for salt, cyanide and lead hardening. Tool and die makers specify 550 for case-hardening; pattern and model makers use it for melting aluminum and nickel-silver. Equipped with steel pot 8"x10", lid, derrick for lifting lid, and Johnson Blower. Complete F.O.B. Johnson Gas Appliance Co., Cedar Rapids, Iowa, \$112.00. Other Pot sizes available — 6x8", 10x12", 10x14", 14x16", 14x20".

Prices on other sizes  
quoted on request.



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GAS APPLIANCES**  
FOR EVERY  
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Please send me full information on Johnson Industrial Furnaces.  
Name \_\_\_\_\_ Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ N

**Let us Check  
your Gage Blocks**



**J**OHANSSON GAGE BLOCKS are vital to defense production. They should be verified frequently, just as your inspector checks his micrometers.

You can take a simple precaution, and fully safeguard your precision through our inspection facilities, which are available at quite nominal charge. Write or phone for particulars.

**FORD MOTOR COMPANY**

Johansson Division (Dept. G)  
Dearborn, Mich.

**J OHANSSON  
GAGE BLOCKS**

furnished complete with all standard attachments. Attachments for internal grinding and a motor driven head for rotating work can be supplied on order. Specifications of the machine are as follows: swing, 8 in.; distance between centers, 16 in.; hand longitudinal feed, 16.; vertical travel of motor, 8 in.; in-out travel of column, 6 in.; net weight, approximately 800 pounds.

**P & W Electrolimit Universal  
Internal Comparator**

Designed to meet the demand for an instrument to measure internal dimensions over a wide range of sizes, the P



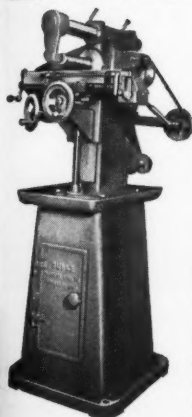
**P & W Electrolimit Universal Internal  
Comparator**

& W Electrolimit Universal Internal Comparator shown herewith has been brought out by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn. The comparator is quick and accurate and will reveal out-of-round, taper, and bellmouth conditions. It is particularly well suited for checking ring gages and similar parts. By taking ordinary precautions in such essential details as cleanliness, temperature, and operating technique, the comparator may be read within an accuracy of 0.00002 inch.

The P & W Electrolimit Universal Internal Comparator covers a range of sizes from  $\frac{1}{2}$  to 10-in. diameters inclu-



## BURKE Milling Machines



No. 4  
Motor Driven  
Milling  
Machine

Mounted on  
Cabinet  
Column

Burke motor driven milling machines Nos. 1, 2, 3, and 4 are specially suited for handling small, difficult work on a production basis.

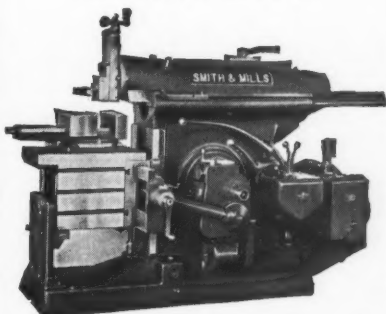
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Automatic lubrication — forced feed. Multiple disc clutch and brake. Quick feed changes. Direct reading feed and stroke dials. Power rapid traverse to cross feeds.

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When You Install Luers Patented Cutting-Off Tools on Your Screw Machines

With these patented blades and holders you get built-in SIDE CLEARANCE, BACK CLEARANCE and FREE CHIP EXPANSION, and 90% of all cutting-off troubles are due to the lack of these three important factors. Check these three vital points against your present equipment:

1. The T-shaped blade prevents excessive side friction.
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For finer, airplane finish, greater production, a saving in blades, a saving in the time required to remove, grind, insert and realign—write or wire today for illustrated literature, prices and full information. Specify the make and model of your equipment.

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Special holders available for use with all types of automatic and hand screw machines.

**EMPIRE TOOL CO.** 8790 GRINNELL AVE.  
DETROIT, MICHIGAN

sive and occupies a floor space of 18 x 20 in. plus a 13½-in. circle for the indicator stand. It operates from any 110-115 volt, 60 cycle, a.c. source having reasonably constant voltage and frequency regulation.

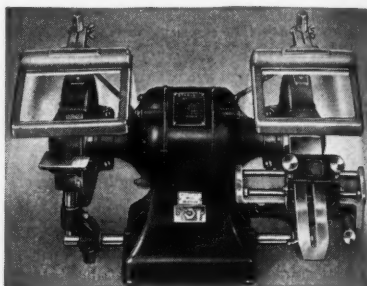
## Stanley Edge Tool Grinder No. 677

Stanley Electric Tool Division, The Stanley Works, New Britain, Conn., is now marketing the Stanley Edge Tool Grinder No. 677 equipped with Stanley "Flud-Lite" Eyeshields. The grinder is a ½ h.p. ball bearing unit with 7 x 1-in. wheels. The eyeshields are connected to the grinder circuit so that lights go on or off as the grinder switch is operated.

The "Flud-Lite" Eyeshields have two bayonet-type light bulbs which are made with a supported filament to withstand vibration. They cannot be moved to a non-guarding position without dismantling. Light from the shields is thrown directly on the work and wheel.

The special motor in Grinder No. 677 operates at the correct slow speed so

that edge tools will not have the temper burned out. Two wheels are furnished with the grinder—a special wheel for

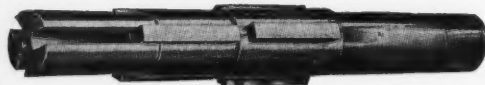


Stanley Edge Tool Grinder No. 677

edge tool grinding and one for general grinding. The wheels are protected with guards and covers, except the working surface, and have exhaust outlets. A plane iron and chisel grinding attachment with a micrometer screw adjustment is supplied. The grinder is available in a.c. or d.c. and has a top speed of 1,800 r.p.m.

## NICHOLSON EXPANDING MANDRELS (Sliding jaw and tapered slot type)

For holding work while being machined between centers on lathes, grinders, millers, shapers, etc.



Both types sold singly or in sets. Made of tool steel, hardened and accurately ground. Economy tools. Prompt delivery at this time.



Also make larger sizes taking up to 7".  
Write for Bulletin.

**W. H. NICHOLSON & CO.**  
136 OREGON ST. WILKES-BARRE, PA.

### TYPE A—STEP JAW DESIGN

Size No.	Range of Bores Taken	Net Price
1A	½" to 1"	\$10.80
2A	1" to 1½"	14.40
3A	1½" to 2"	20.70
4A	2" to 3"	30.60
5A	3" to 4"	36.00

### TYPE B—STRAIGHT JAW DESIGN

Size No.	Range of Bores Taken	Net Price
1X	½" to ⅝"	\$ 9.00
2X	⅝" to 21/32"	9.90
3X	21/32" to ¾"	10.80
00	¾" to 7/8"	12.60
0	7/8" to 1"	14.40
1	1" to 1¼"	16.20
2	1¼" to 1⅝"	18.90
3	1⅝" to 2"	26.10
4	2" to 2½"	36.00

## IF YOU USE TAPS YOU NEED WALTON TAP EXTRACTORS



The price of a new tap is nothing, compared to the cost of removing the broken one by any other method. WALTON BACKS it out; saves the thread (and your time).

Stock sizes #4 to 1 1/2" in 2, 3 and 4 - flute styles. Sent on 30 day free trial. Booklet 132 gives details and prices. Write for it today.

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## "NEW D & W" MAGNETIC CHUCKS

Styles 7 x 17 and 6 x 13

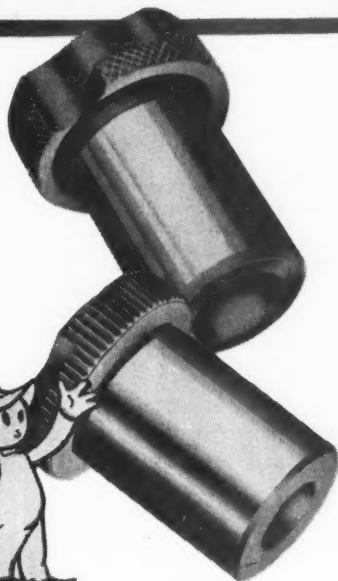


Developed to meet demand for chucks lower than our standard style.

*Send for folder covering  
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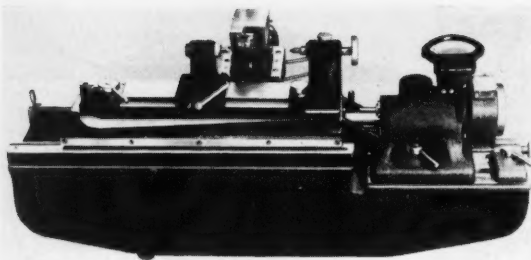
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YOU GET MORE FOR YOUR  
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DRILL BUSHINGS...



Bores are super-finished, straight and round within .0001. Domes are black, rust proof and knurled. Lock Screws are made from nickle steel and cadmium plated. All standard sizes available. Write today for complete facts and prices.

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P & W Lead Tester

### P & W Lead Tester

The P & W Lead Tester shown in the illustration herewith, product of Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn., provides great accuracy, speed, range, and flexibility in checking thread leads. It is exceptionally heavy and sturdy, occupying a bench space of 37 x 17 in., and is 15 in. high. The unit will handle parts up to 4 3/4 in. in diameter, with a thread length of 4 in. and an overall length of 8 in. The measuring head is

designed to read accurately within 0.000025 in. Tape threads as well as straight threads may be checked by correctly positioning the swivel work supporting table.

The P & W Lead Tester belongs in the class of basic measuring equipment and is a direct reading instrument. Regular equipment includes one 4, 3, 2, and 1 in. Hoke precision gage block, and a set of 7 ball points for 4 to 80 threads per inch.

### Pratt & Whitney Adjustable Limit Snap Gages

Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn., is now marketing an adjustable limit snap gage which is available in two types; namely, the P & W Model "C" Trusform Adjustable Limit Snap Gage and P & W AGD Adjustable Limit Snap Gage shown herewith. The Model C gage is equipped with one solid anvil

*Will a*

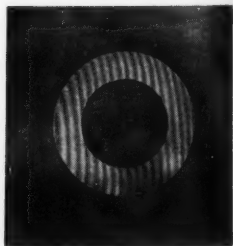
## Flatter Surface improve your product?

Many people have parts, such as seals, which can be improved by greater accuracy of the lapped surface.

Acme lapping technique has been developed to make possible the finishing of parts in production to within five millionths of an inch. (.000005") from absolute flatness. The cost is surprisingly low.

Our Engineering Department is available for advice on lapping problems. No obligation, of course.

*May we discuss your problem?*



The straightness of these bands formed by interference of light waves reflected from the flat-lapped steel surface gives a true measure of its flatness.



## ACME INDUSTRIAL CO.

Makers of Standardized Jig and Fixture Bushings

212 N. Laflin St.

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- NO SPALLING
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- MORE EFFICIENCY
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Heavy Bevel, Light Bevel, and Wedge Grip Lettters and Figures for every type of marking.

No stamp is more economical regardless of price. Write for literature.

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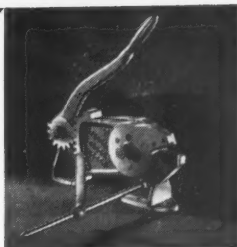
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# THE NEWEST in CUTTERS

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The  
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**CUTS** — Wire and rods up to  $\frac{3}{8}$  in.

**CLIPS** — Band iron up to  $\frac{1}{8} \times 2$  in.

**MEASURES** — Length of pieces.

The lowest-priced wire and band cutter on the market. Every shop, big or small can use a WONDER CUTTER.

Write today for  
further information and prices.

**The Federal Foundry Supply Co.**

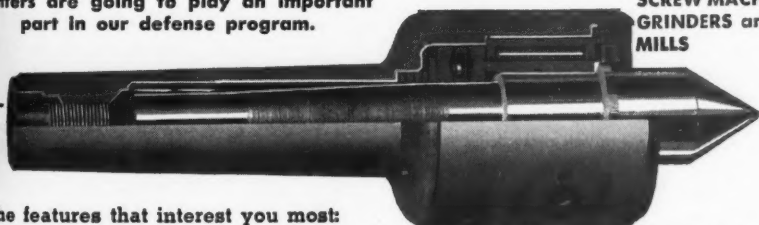
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# THE CENTER OF ATTRACTION

Economical Live Ball and Roller Bearing Centers are going to play an important part in our defense program.

For LATHES, HAND  
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The features that interest you most:

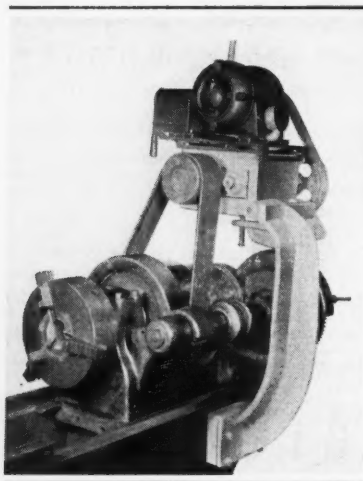
1. Simplicity, sturdiness, and heavy duty.
2. 50% more radial load carrying capacity than the average live center.
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5. Special oil seal to retain lubricant and keep out foreign matter.
6. A compression pad to compensate for heating and expansion of metal as a safety factor, with reasonable diligence exercised.

A folder giving prices and complete details will be mailed to you upon request.

A ten-day trial. If not perfectly satisfied, your money will be cheerfully refunded.

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No one drive meets all your requirements advantageously. Be sure to choose the correct type drive to fit your need. We offer V Belt Drives, Gear Motor Drives, 4 speed Gear Box Drives. Send us a list of your requirements and get unbiased recommendations.

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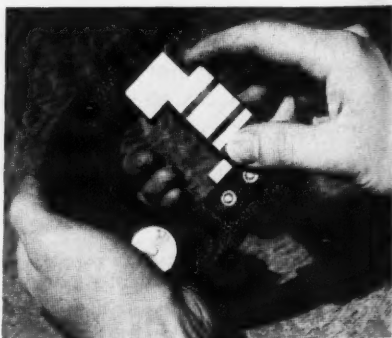


P & W Model "C" Trusform Adjustable Limit Snap Gage

two adjustable anvils, and Bakelite insulating grips. The Trusform frame is finished square so that the anvils are parallel and in line.

The Bakelite grips of the gage insulate it from the heat of the operator's hand. These grips are designed to carefully fit the average hand, thereby facilitating the handling of the gage as well as insulating it.

The solid anvil projects beyond the end of the frame and the adjustable anvils, thereby permitting the gage to locate itself quickly on the work. In addition, the anvil is made flush with the side of the frame to permit the operator to check close to a shoulder. The anvil fits into an accurately ground seat in the



P & W AGD Adjustable Limit Snap Gage

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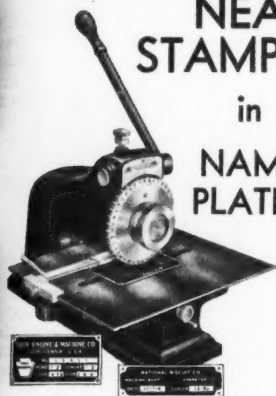
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## NEAT STAMPING

in

## NAME PLATES



This machine quickly stamps details and serial numbers into name plates.

Write for Particulars

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## TEN TIMES THE LIFE OF TOOL STEEL CENTERS



HIGH SPEED CENTERS.

because RED-E CENTERS have high speed steel ends which will outwear ten tool steel or carbon centers.

CATALOG S-41

**THE READY TOOL CO.**  
510 IRANISTAN AVE.  
BRIDGEPORT • CONN.

## HERE'S OUR NEW BABY

### == RUTHMAN == **GUSHER** COOLANT PUMPS

Like the larger Gusher pumps, the new baby Gusher Model P-3 (for use where only a small quantity of coolant is required) has built-in motor, sturdy vertical shaft on ball bearings, double suction intake giving balanced impeller—all of the famous Gusher features. Write for engineering data and specifications.

A complete line of Coolant Pumps from 1/30 to 2 H.P. in types and capacities up to 200 gal. per minute, a pump for every requirement you may have. Ruthman Gushers come in immersed types, tank units, pipe-connected types, flange mounted types and plain drive types. There is a Ruthman Gusher Coolant Pump to meet every type of machine tool coolant requirement. Sheets giving dimensions and performance curves are yours for the asking.



Model P-3

P-3 is available in external right or left discharge models, flange-mounted and immersed models.

Pat. and Pats. Pend.

**THE RUTHMAN MACHINERY CO.**

538 EAST FRONT STREET

CINCINNATI, OHIO

LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

gage frame and is held rigidly in position by means of two screws.

The adjustable anvils have a rectangular head which provides a broad wearing surface, and are interchangeable. The heads are made of high grade tool steel, are heat-treated, and then lapped flat and square with the shank, which is accurately ground. The lapping is done by an adaptation of the Hoke process to provide maximum bearing with a longer wearing surface combined with fine accuracy.

The Trusform frame is made of a high grade, close grained grey iron, seasoned to assure stability. The bridge truss design is extremely rigid and very light. Four metal identification discs are screwed to the frame ready for stamping.

The P & W AGD Adjustable Limit Snap Gage is made to the same high accuracy standards as the Trusform gage. The frame is made in accordance with the design adopted by the American Gage Design Committee. Like the Trusform, the AGD gage provides a check for maximum and minimum diameter in one gage so arranged that a single hand motion completes the inspection. It is available in a wide range

of sizes and types to suit various requirements.

The P & W AGD Snap Gage has a frame of high grade, close grained grey iron, seasoned to assure stability and machined to accurate masters. All anvils are tool steel and are hardened, ground, and lapped. According to the manufacturer, the AGD gage will retain its accuracy under severe usage, is easy to set to master standards, and can be sealed to prevent tampering.

## Rockford LMC Clutch

Illustrated herewith is a toggle-type, over-center clutch which has been developed by Rockford Drilling Machine Division, Borg-Warner Corporation, 300 Catherine St., Rockford, Ill. The clutch is intended for use with gasoline or other motors or in other applications up to 6 h.p., and is said to be compact, powerful and durable. Outstanding features of the clutch are its simple design, use of high-grade materials, and precision machining of parts. Suggested applications include conveyors, hoists, pumping equipment, tool grinders, tractors, saws, and so on.

*"The Right Tap at the Right Time"*

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- Special or Standard Taps
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- Cut and ground thread
- Catalog No. 5 gives complete data.



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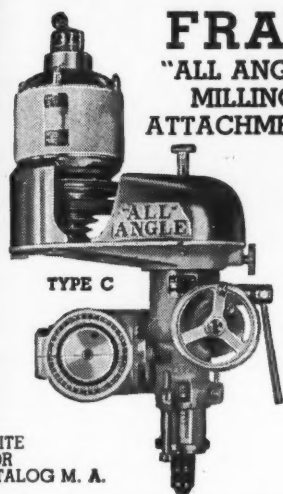
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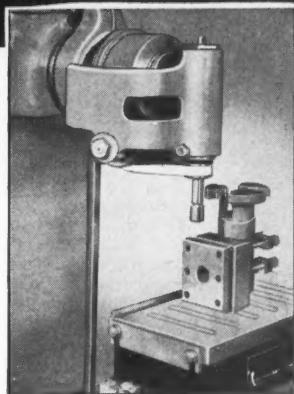
## FRAY "ALL ANGLE" MILLING ATTACHMENTS

TYPE C

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FOR  
CATALOG M. A.

**FRAY MACHINE TOOL CO.**  
GLENDALE, CALIF.

## New Grinding Attachment for TOOL and DIE and GAGE WORK



The LIBERTY High Speed Grinding Attachment fits Brown & Sharpe, Reid and other makes of surface grinders.

1. Grinds slots, recesses and surfaces, etc., which are impossible to reach with large wheel.
2. Eliminates expensive set-up time in which small wheels are necessary. Takes only a few minutes to attach.
3. Handles wide variety of tool, gage, die and other grinding.
4. Extreme accuracy—precision bearings throughout.
5. Spindles of both vertical and horizontal attachments can be shifted to numerous positions.

Assembled complete with any size bores, pulley, belts and grinding wheels at no extra cost.

Write—specifying diameter of spindle head, type and make of grinder.

# LIBERTY TOOL & GAGE WORKS

235 GEORGIA AVE. • PROVIDENCE, R. I.

## CYLINDRICAL SUB-PRESSES

Have several advantages. Alignment is easily obtained and maintained. For circular punches and dies they are particularly economical and for irregular shapes they can be handled as conveniently as other types. Our Booklet on Sub-Presses and Dies shows when they should be used. Ask for it.

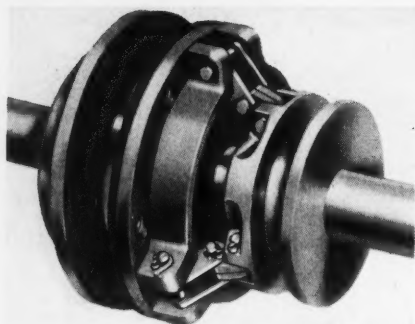


ARCH TYPE

**Waltham Machine Works**

Waltham

Massachusetts



Rockford LMC Clutch

The clutch transmits 1 h.p. at 100 r.p.m. and handles proportionately smaller or larger horsepower as speeds decrease or increase up to a maximum of 6 h.p. The strong symmetrical body of the clutch is accurately machined, as is the steel shifter-spool. The operating links, pins, and rollers are of hardened steel. The toggle action goes "over-center," locks the clutch in driving position, and provides easy engagement

and an unusually powerful pull.

The clutch plates are of steel, hardened and ground. High-grade facing material is securely fastened in place. Pressure for driving is uniformly distributed and applied directly opposite the facing where it is most effective. No oiling is necessary for the accurate metal bushing which carries the driven sprocket, pulley, sheave, flange, or other part of the machine in which the clutch is installed. The steel end-plate is threaded for fine adjustment, and has a fibre protecting plug and slotted locking screw.

## Metco Type 2E Metallizing Gun

Shown herewith is the Metco Type 2E Metallizing Gun which is now being marketed by the Metallizing Engineering Co., 21-07 41st Ave., Long Island City, N. Y. The gun may be used as a hand tool for coating large structures with zinc, aluminum, lead, or other metals, or a lathe tool for building up worn shafts, rolls, plungers, and so on, with steel, stainless steel, Monel metal, bronze, or any other metal obtainable in wire form.

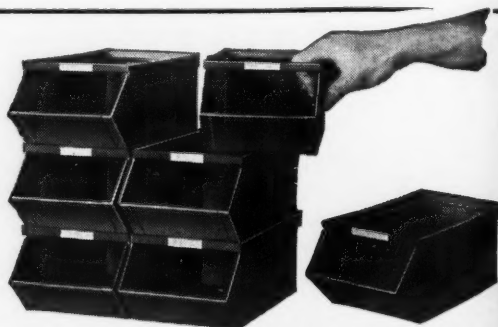
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# PARTS

where you  
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when you  
want them



You'll save time, space and labor handling parts and materials when you use these patented **STACKBINS**. **STACKBINS** keep parts instantly accessible — eliminate waste hand motions — stack compactly to form units of exactly the right shape and capacity—make order filling or assembly work faster, easier, more efficient.

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"STACKED AND STILL ACCESSIBLE"

Write today for full story on patented **STACKBINS**, and learn new lessons in efficiency. Stackbin Corp., 53 Troy St. Providence, R. I.

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**BETTER  
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**MORE ACCURATE  
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In hundreds of shops, ILLINOIS Die Filing Machines are turning out accurate work many years after their original purchase. Experienced diemakers who have operated various types of filing machines know that an ILLINOIS is quality built throughout and will stand up longer, while producing more accurate work. Write for descriptive literature today.

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**TANNEWITZ High Speed  
METAL CUTTING BAND SAWS**

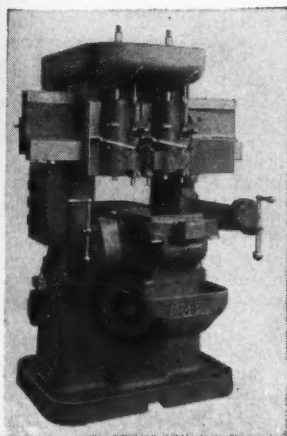
Fastest and best known means of cutting sheet steel, aluminum and magnesium sprues, gates, risers, and kindred items.

Provides sawblade travel of over 2-miles per minute with PERFECT SAFETY. Cuts are exceptionally smooth. Write for Metal Cutting Band Saw Bulletin.



**THE TANNEWITZ WORKS  
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**MOREY No.12M Vertical Profiler  
and Milling Machine**



**Low Cost Milling of Small Parts**

Production of interchangeable parts requiring milling of any contour or outline can be materially speeded up by this Profiling and Milling Machine.

**Ask for descriptive bulletin.**

**MOREY MACHINERY CO., INC.**

410 BROOME ST.

NEW YORK, N. Y.

# ATLANTIC

**NON-TEMPERING  
TOOL STEEL**

In the New Steel Shape

**FLUTAGON**

**The SAFETY  
STEEL**

This new steel shape furnishes a convenient, positive grip for chisels, punches, cutters and blacksmiths' tools.

This shape minimizes chipping and splintering.

Forging is simplified because there are no sharp corners to hammer into surface as on octagon and hexagon shapes.

Distinctive  
• • •  
Vacuum Grip  
• • •  
Safer

Write for complete details

## ATLANTIC STEEL CO.

1775 BROADWAY, NEW YORK, N. Y.

Developers of Non-Tempering Tool Steel

In operation, the wire metal is automatically fed into the gun at an adjustable speed where it is melted by means of concentrated flame, atomized by compressed air, and sprayed on any base material.

The Type 2E gun has two outstanding features—a controlled power unit and universal gas head. The controlled power unit controls the wire speed by means of a governor operating on the power



Metco Type 2E Metallizing Gun

absorption principle, thus permitting full power input at all times and eliminating speed fluctuations under varying loads and the necessity for changing the gears in the gun. The universal gas head permits the use of acetylene, propane, hydrogen, natural, or manufactured gas with balanced pressures and without changing heads or dismantling the gun in any way.

In addition, the gun has improved spraying characteristics. Extremely fine coatings are obtained at production speeds, which feature combined with simplified adjustments permits continuous operation with maintained speed and quality. Improved nozzle and jet construction reduce gas consumption and result in efficient and economical operation. Lightweight, perfect balance, and easy hand grip combine to eliminate operator fatigue. Maximum air pressure required is 65 p.s.i. Rugged in construction, the Type 2E gun is



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power

*Quicker assembly . . .*  
*Lower cost with*  
**WHITNEY**  
*Woodruff*  
**KEYS**



• Whitney keys are easily fitted — because they're accurately made. That means time-saving, money-saving assembly of shaft and keyed member. Yet Whitney keys reach deep in the shaft, stand greater strain, can't roll over. Write for Catalog V-111 and price list.

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HARTFORD • CONNECTICUT

**DRIV-LOK**



**SELF - LOCKING  
DRIVE PINS**

Improve your assembly and cut your costs by replacing taper pins, straight or cotter pins, keys and rivets with this new fastening pin.

Use straight drilled holes, no tapping or reaming. Diameters,  $1/32''$  to  $3/8''$ .

ASK FOR CIRCULAR AND SAMPLES

**THE DRIV-LOK CO., INC.**

1525 Railroad Ave.

Bridgeport, Conn.

**PERFORATED PILING BOXES  
USED ON TRUCKS AND RACKS**



We are well equipped to fabricate boxes, barrels, shelving and other sheet metal products in all gauges to your own specifications. Our general catalog mailed on request.

**THE CLEVELAND WIRE SPRING COMPANY • SHEET METAL DIVISION • CLEVELAND, OHIO**

ideal for heavy duty metal spray work.

The complete tool is extremely light, weighing only 4½ lb. The gear case is made of aluminum alloy and is completely sealed. Simple two-piece case construction combined with removable drive gear and roll makes the unit easy to clean and inspect. Precision ball bearings are used throughout. Bearing housings constructed of brass are mounted in the case. All parts affecting alignment are assembled with dowel pins or cylindrical fits. Alignment is not dependent on threaded sections. Worms are cut integral with their

shafts and are ground after hardening. Wire nozzles are of bronze with a hardened, heat-proof lining which, it is claimed, will not fuse or stick to the metal being sprayed. The gas head is made of a dense pressure tight bronze and separated completely from the case assembly, thereby eliminating any danger of inflammable gases collecting in the case. All parts are completely interchangeable and may be assembled without adjustments.

### Norris Brothers Bottom Pour Babbitt Ladle

A ladle for molten metal designed to pour from the bottom—where the metal is always clean—so as to save metal that would otherwise be lost through skimming dross and dirt from the top is now being marketed by Norris Brothers, Inc., Robinson, Ill. A heat shield flange, ventilated sliding sleeve, and large-diameter base are also features of this ladle.

The bowl of the ladle is made of a high-grade alloy which will withstand heat and temperature changes throughout a long period of service. The handle is of bar carbon steel and the sliding sleeve is a special malleable iron casting so designed that it has a two-point bearing on the handle with an air space between and also has a flange to shield the operator's hand from the heat of the molten metal. The sleeve can be easily moved along on the handle to the most advantageous point for handling.

The bowl is designed with the spout on the outside, opening into the bottom of the bowl so that, as the ladle is tipped, the metal will pour out through the spout from the bottom, rather than off the top. Thus the metal used is al-

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**REAMERS**  
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**END MILLS**

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Special Reaming Problems Involved  
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Tools

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**ROTARY POWER CUTTERS**

**"Ground from the Solid after Hardening"**

DESIGNED AND SERVICED BY

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1516 East Genesee Avenue      SAGINAW, MICHIGAN

**R E G R I N D   T O   S A V E   T I M E**

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## MILWAUKEE SURFACE PLATES



36" x 48" . . . semi-steel . . . accurately machined. Securely mounted cast legs are machined and provided with adjusting screws for perfect alignment. Shipping weight, 1250 lbs. Also larger or smaller plates with planed or scraped surface.

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## MILLING ATTACHMENT

**HIGH SPEED**

**\$165.<sup>00</sup>**

**1/3 H.P. MOTOR  
RIGHT & LEFT ANGLE**



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**STEINER PRODUCTS CORP.**

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## Try Mac-it Hex Head Cap Screws

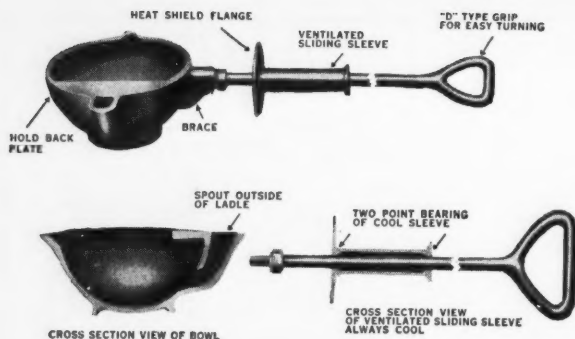
With a minimum tensile strength of 145,000 pounds per square inch, you'll find these stock cap screws plenty tough.

Mac-it hexagon head cap screws are milled from solid bars of special alloy steel. All hex corners are clean and true. Threads are die-cut and accurate in pitch diameter and lead. Mac-it heat treatment gives maximum strength and toughness.

Consult your distributor  
or write us direct.

3

**THE STRONG, CARLISLE & HAMMOND COMPANY**  
1392 West Third St., Cleveland · Ohio



Norris Brothers Bottom Pour Babbitt Ladle

ways the clean metal from the bottom regardless of the amount of dross or dirt which may be floating on the top. This type of construction saves time and trouble lost in skimming the metal frequently. A retaining plate over the top of the ladle on the spout side prevents spilling of metal over the side of the bowl and thus permits faster pouring. A large base on the bowl allows for setting the ladle down without spilling.

To provide for the handle, a boss is cast on the side of the bowl with a heavy brace cast integral to support the boss. The handle hole is tapped into the boss and completely through the wall of the bowl, permitting weight strain to be evenly distributed. The handle has a spade type grip for easy manipulation in pouring.

The Norris Brothers Bottom Pour Ladle is made in seven sizes, with bowl diameters of 3, 4, 5, 7, 8, and 10 in. and bowl depths from 2½ to 6 in. Handle lengths vary accordingly from 12 to 36 in. and weights are from 3 lb. for the No. 3 size to 33 lb. for the No. 10 size. Capacities range from ½ pt. for the No. 3 to 10 pt. for the No. 10, or 4½ lb. Babbitt for the No. 3 to 116½ lb. of Babbitt for the No. 10. The ladle is guaranteed 100 per cent against defective material and workmanship.

## SPEED AND ACCURACY IN GRINDING CONTOURS



Curved and irregular shapes in dies, punches, molds, cams, templates — finish ground without intricate set-ups.

This versatile precision Tool grinds dies and punches to close tolerances, after hardening.

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and Full Description*

**BOYAR-SCHULTZ CORPORATION**  
2120 WALNUT STREET CHICAGO, ILLINOIS

## Hand Cut ROTARY FILES

High Carbon and High Speed Steel.  
All sizes—all shapes. Write for catalog.



STRATFORD

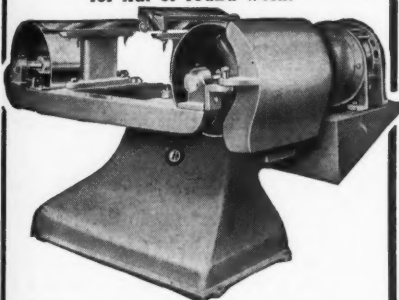
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## FAST PEERLESS

### Abrasive Surfacers

These machines are extremely fast for grinding and sanding flat surfaces of metal, wood, rubber, plastics, etc.

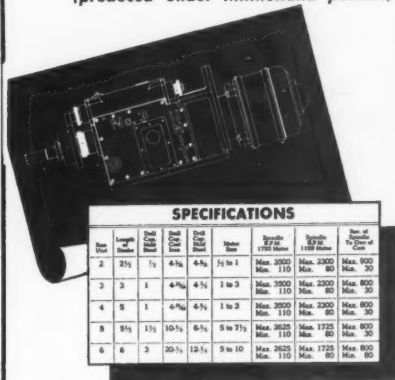
Other types Vertical and Horizontal  
for flat or round work.



**PRODUCTION MACHINE CO.**  
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## Another Improvement in EMPCO UNITS

(produced under Millholland patents)



### SPECIFICATIONS

Size	Weight	Speed	Feed	Stroke	Power	Capacity of 1700 Series	Capacity of 1700 Series	Rate of Change of Feed
2	2 1/2	7 1/2	4 1/2	4 1/2	1/2 to 1	Max. 2000 Min. 110	Max. 2300 Min. 80	Max. 003 Min. 30
3	3	1	4 1/2	4 1/2	1 to 3	Max. 3000 Min. 110	Max. 3300 Min. 80	Max. 003 Min. 30
4	5	1	4 1/2	4 1/2	1 to 3	Max. 3000 Min. 110	Max. 3300 Min. 80	Max. 003 Min. 30
5	8 1/2	1 1/2	10 1/2	6 1/2	5 to 7 1/2	Max. 3025 Min. 110	Max. 3300 Min. 80	Max. 003 Min. 30
6	6	3	20 1/2	12 1/2	5 to 10	Max. 3025 Min. 110	Max. 3300 Min. 80	Max. 003 Min. 30

## Build your own DRILLING, MILL- ING and TAPPING MACHINES

Keep tools actually producing 80%  
to 88% of the working time.

Outstanding for their speed production and versatility, Empco Units meet today's recognized need for the utmost in efficiency.

This unusually high production is made possible thru the specially designed cam. Operating cycle cut one-third.

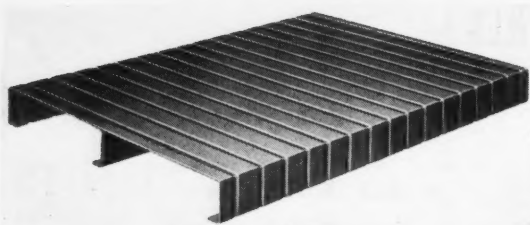
Use of plate type cams, simple feed, and speed gears, plus interchangeability of same sized units and parts, permits change-over at minimum cost. Units designed especially for heavy work.

Our engineers can design and build any machine composed of these units—also build fixtures.

Write for illustrated and  
descriptive circular



**ENTERPRISE  
MACHINE PARTS CORPORATION**  
2737 JEROME AVENUE DETROIT, MICHIGAN



Union Single Face Pallet

### Union Single Face Pallet

The Union Metal Manufacturing Company, Canton, Ohio, announces a new and improved all-steel light weight pallet particularly designed for freight handling between the customer and consumer. The pallets are intended as a returnable package. The return freight cost is small.

The top deck and legs are formed in one piece and the number of channel spacer supports depends upon the width and load. The legs and spacers are provided with a return bottom flange adding further strength and serving as a

floor protector. The gauge of metal used in the pallet depends upon the strength requirements, and the customer's needs determine the size.

Double-faced pallets can be furnished by the addition of a slotted or solid bottom deck. These pallets are suitable for handling with hand pallet and/or power fork trucks.

### Hammond 6-In. Carbide Tool Grinder

A carbide tool grinder using 6-in. silicon carbide or diamond wheels has been placed on the market by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. The grinder stresses heavy, machine tool construction for strength and solidarity.

Features of the machine include extra heavy tilting tables which can be easily removed without the aid of tools. To install new wheels, a single clamp

## SWISS-AMERICAN GEAR MFG. CORP.



110-114 HOBOKEN AVENUE  
JERSEY CITY • NEW JERSEY

**Will CUT and GRIND  
Spur and Spiral Gears**

### MAAG GROUND GEARS

are accurate, interchangeable, run noiselessly; have no hair cracks.

Short deliveries. Send drawings with inquiries to:

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(Ask for Gear Specialist)



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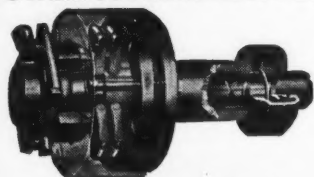
## MULE-PULL CLUTCHES

Have all their working parts compactly enclosed to protect your workmen against serious injury.

Have a system of Ring-Oiling Lubrication which eliminates loss of production through ground-out sleeve bearings.

Have a simple, anti-friction system of roller leverage that imposes extreme pressures upon dual friction plates and gives these clutches their

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## CADILLAC

PORTABLE ELECTRIC  
**BLOWER & SUCTION CLEANER**

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DIRT IS DANGEROUS AND DESTRUCTIVE AND A CLEMENTS-CADILLAC WILL ELIMINATE THIS CAUSE OF COSTLY DELAYS—EASILY, THOROUGHLY, ECONOMICALLY.

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## DoAll BAND FILES

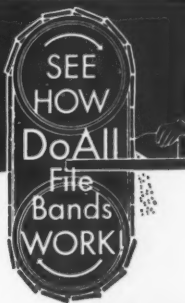
TAKE THE PLACE OF MANY HANDS

For greater speed and accuracy in internal and external band filing, nothing will equal the results obtained with DoAll Band Files, which form an even, rigid file at point of work and automatically unlock to pass smoothly over wheels.

**DoAll Band Files**  
come in 3 widths,  
23 styles, cuts and  
sizes. Send for  
Literature today.

### The DoAll Company, Inc.

1204 THACKER ST., DES PLAINES, ILL.  
Associated with Continental Machines, Inc.,  
Minneapolis, Minn.



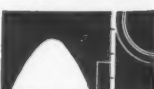
1 Hour of Hand  
Filing produces  
2 oz. Chips.



1 Hour of Jig  
Filing produces  
4 oz. Chips.



1 Hour of DoAll  
Band Filing pro-  
duces 19 oz.  
Chips.



releases each table which may be quickly slid off the 1 $\frac{3}{4}$ -in. supporting shaft. The tables are slotted for a

Hammond 6-In.  
Carbide Tool Grinder

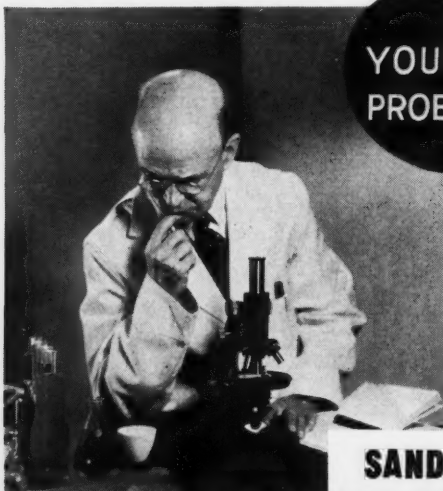


protractor angle-guide furnished with the machine. The inside edge of each table is machined inward at an angle

to permit tilting of the table without readjusting the distance between the table and wheel. The cast iron support under each table also serves as a sludge pan and is easily removed and cleaned by releasing the same clamp that locks the table to the supporting shaft.

For accuracy in grinding angles, a plainly marked indicator having a range of from 0 to 25 deg. is mounted directly beneath each table. The tables tilt to the exact angle of adjustment easily, sliding on machined quadrants. The motor is a  $\frac{1}{2}$  h.p., 3,450 r.p.m., heavy duty type with oversize, precision ball bearings, and mounts silicon carbide wheels of 6 x 1 $\frac{1}{4}$  x 1 $\frac{1}{4}$ -in. size or diamond cup wheels of 6 x  $\frac{3}{4}$  x 1 $\frac{1}{4}$ -in. size. The motor is reversible for right or left-hand grinding and is controlled by a switch at the front of the machine.

For wet grinding, an integral wheel guard and coolant tank may be easily substituted for the standard cast iron wheel guard. Coolant is carried to the wheel by way of a copper tube. Needle valves atop the coolant tank control the flow.



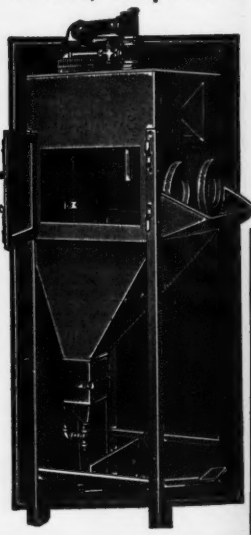
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Better Finish.  
Removing Scale.  
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Dips or the  
Scratch Brush.

LEIMAN BROS.

**SAND BLAST**

for All Metals, Glass,  
Plastics, Compositions



**LEIMAN BROS. INC.**  
188-2 Christie St.  
Newark, N.J.

## SUPER - PRECISION GRINDERS

For Lathes, Shapers, Milling  
Machines, Boring Machines

A Full Line of  
Portable Precision Grinders

**THREAD GRINDING** — An important feature of our grinders is that they are built to grind threads efficiently and accurately. A dressing attachment is furnished which forms the wheel to any desired thread form. Threads like on taps and thread gauges, can be ground full depth from the solid after the part is hardened practically as fast as they can be cut.

**GENERAL MACHINE TOOL CO.**

SENECA FALLS

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BOWEN

LUBRICATORS

OIL CUPS  
GREASE CUPS

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INDUSTRIAL  
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SYSTEMS

**BOWEN PRODUCTS CORP.**

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ROTARY  
FILES



GROUND  
ROTARY  
CUTTERS

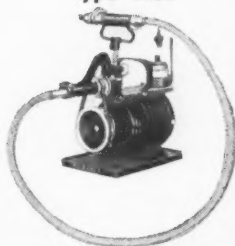
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Type M54



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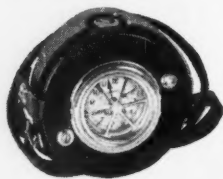
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# This 7-inch FIRE BOMB Can WRECK Your Plant!

AS INNOCENT-LOOKING as a fountain pen — yet casually dropped in your plant this fire bomb can destroy vital tools, dies, fixtures and precision instruments.

The one effective way of discouraging sabotage is to keep your Watchman on his toes by controlling his activities with a DETEX Watchclock System.



Requires no wiring or batteries. Usually pays for itself the first year by lowered insurance rates. Write today for a DETEX Representative.

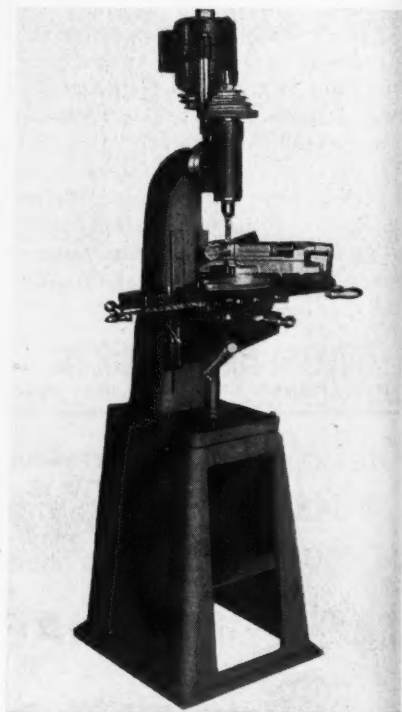
**DETEX WATCHCLOCK CORPORATION**  
Dept. M-6

Home Office: 76 Varick Street, New York  
Sales and Service in All Principal Cities

# DETEX

## Univertical No. 1 High Speed End Milling Machine

Shown here is the Univertical No. 1 High Speed End Milling Machine for handling various types of small jobs which has been brought out by the Univertical Machine Co., 620 St. Antoine St., Detroit, Mich. Capable of the



Univertical No. 1 High Speed End Milling Machine

most exacting precision work, this rugged, compact, and powerful machine mills, drills, and bores. It is also said to be a highly efficient contour miller. The machine is designed for use with cutting tools up to  $\frac{5}{8}$  in., and can also be adapted to small grinding operations.

According to the manufacturer, the Univertical No. 1 High Speed End Milling Machine has perfect balance and is without vibration. Smooth operation and a minimum of maintenance

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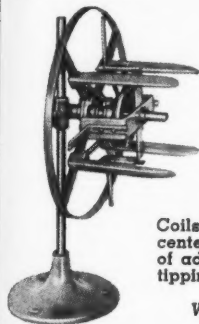
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## "WESTLEN" Self-Centering REELS

One-piece ADJUSTABLE CLAMP holds stock in perfect position.



WHEEL automatically adjusts posts to suit diameter of coil.

CROSS PIECE easily converted to vertical or horizontal position and adjusts height of reel.

Coils are automatically centered by a few turns of adjustment wheel. No tipping — no back lash.

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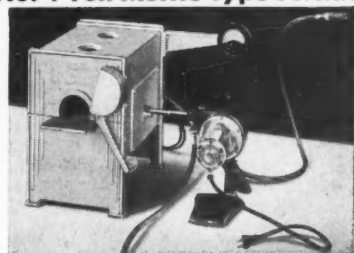
**WESTLEN MFG. CO.**

380 Mountain Grove St., Bridgeport, Conn.

## "Stark"

"ELECTROBLAST"

No. 1 Full Muffle Type Furnace



High grade insulated Furnace. Silicon Carbide Muffle 7" x 3 1/2" x 2 1/8", \$40. Burner can be used as handy portable Torch for soldering, melting, forging, etc. Blast actuated by powerful Universal ball bearing motor. Torch alone, \$30. Unit will reach 2350°F. in less than half hour at 7c per hour. Noble metal Pyrometer, \$65. Unit equipped for Hydrogen Brazing as illustrated, extra. Write for descriptive literature.

**STARK TOOL CO.**

Originators of the American Bench Lathe  
Est. 1862 **WALTHAM, MASS.**

## REID No. 2-1 Automatic Feed SURFACE GRINDER

Mechanical and hand feeds with reciprocating table and horizontal spindle. High-grade, heat-treated Chrome-Molybdenum steel spindle runs in phosphor-bronze boxes. Vertical adjustments with handwheel graduated to .0005". Work table is automatic in both directions and is controlled by dogs operating against a reverse lever.

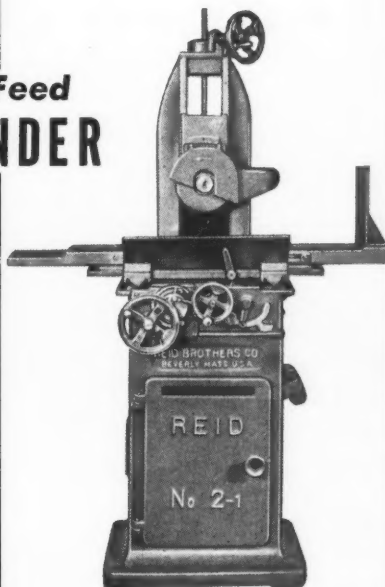
Grinds work 18" long, 6" wide and 11 1/2" high, using a 7" diameter wheel. Write for circular.

Exclusive Selling Agents

**H. LEACH  
MACHINERY CO.**

387 Charles St., Providence, R. I.

Distributors in all leading cities



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PRECISION  
GRINDING

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941

June, 1941

MODERN MACHINE SHOP

251

are said to ensure efficient, dependable, and trouble-free performance over a long period of time. Specifications of the machine are as follows: spindle—thrust ball bearings; spindle speed range, 400 to 3,400 r.p.m.; straight; collet capacity,  $\frac{5}{8}$  in.; drawbar; table—dimensions, 24 x  $4\frac{7}{8}$  in.; two T-slots  $\frac{1}{2}$  in. wide; table travel—longitudinal, 17 in.; cross travel, 7 in.; vertical, 10 in.; all table movements graduated to 0.001 in.; spindle head—swings through 180 deg.; work clearance of  $6\frac{1}{2}$  in. from center of spindle to supporting column; motor—heavy duty  $\frac{1}{4}$  h.p.; ball bearing; 60 cycles, 1,700 r.p.m.; adaptable to either 110 or 220 volts; types—bench model, overall height, 44 in.; floor model, overall height, 70 inches.

### "Chicago" Improved Soft Rubber Polishing Wheel

An improved soft rubber polishing wheel by means of which highly polished surfaces can be produced rapidly on any base metal is announced by the Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Dept. MM, Chicago, Ill.

Five different types of polishing compound are impregnated in a special rubber binder. In addition, the wheel has



"Chicago" Improved Soft Rubber Polishing Wheel in Use

sufficient cutting grit to remove scratches and grinding marks from the part being polished. Popular sizes and

## Low Prices on WESSON

### Standard Carbide Tools Make Them Practical for EVERY Job!

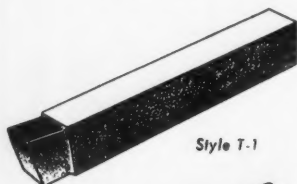
Now you can have all the advantages of carbide tools on EVERY job! Drastic price reductions have been made possible by Wesson's increased production and the lowered cost of Carboloy metal. Wesson's standard carbide tools are made in 5 styles and furnished in 3 grades of Carboloy—2 for cast-iron and one for steel. These standard tools will cover 80% of all your carbide tool requirements. All tools are ground ready for use. Steel-cutting tools include ground-in chip-breaker. Wesson carbide tools speed up your production and lower your costs. Order now and avoid delay.

Send for Catalog and Price Sheets

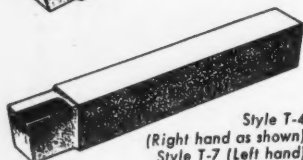
### WESSON CO.

Mfrs. of High Speed Steel and Cemented Carbide  
Cutting Tools for All Purposes

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FERNDALE MICHIGAN



Style T-1



Style T-4  
(Right hand as shown)  
Style T-7 (Left hand)



Style T-13  
(Right hand as shown)  
Style T-14 (Left hand)

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80th and  
June,



## for TURRET LATHES

### Precision COLLET CHUCK

Drill sets to any distance. Better Grip. Faster Speed.

Greater Accuracy. Grips on 8 points instead of customary 3 or 4.

Chuck Shank supplied for any spindle — male or female. Grips on flutes as well as on Shank.

Positive Thrust Screw stop.



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Sizes.  $\frac{1}{8}$ " Dia. to  
No. 80 Drill.

**ERICKSON STEEL CO.**

80th and Bessemer

Cleveland, Ohio

## OSTER

MEETS THE NEEDS OF  
*The* NATIONAL DEFENSE

### NEW NUMBER 601 HAND OPERATED SCREW MACHINE

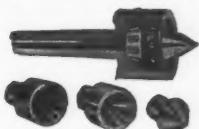
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*The* OSTER MANUFACTURING CO.  
2061 EAST 61st STREET  
CLEVELAND, OHIO

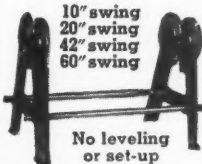
## SPEED-UP TOOLS

### IDEAL LIVE CENTERS



Save Hours On Centering Work in  
Lathes, Grinders, Millers, Etc.

- Three interchangeable Male and Female inserts fit all work.
- Work with heavier loads at higher speeds.
- Make Work Easy — Increase Production!



No leveling  
or set-up

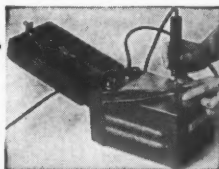
**IDEAL**

### BALANCING WAYS

Simplify balancing  
crankshafts, pul-  
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etc. No centers  
required.



### IDEAL "UNIVERSAL" METAL ETCHER



Marks Parts, Tools, Permanently

Prevent loss and confusion by permanently marking identification on all smooth-surfaced tools, dies, metal parts and products with the IDEAL Metal Etcher. Engraves metal quickly, permanently. Has four etching heats. Streamlined, everything enclosed. Other models for very fine or heavy duty etching.

### IDEAL ELECTRIC MARKER

An inexpensive, lightweight tool that quickly and permanently marks practically any surface: steel, glass, ceramics, etc.

### Prompt Shipment

**Ideal Commutator Dresser Company**  
1031 PARK AVENUE, SYCAMORE, ILLINOIS  
"Sales Offices In All Principal Cities"  
In Canada:  
Irving Smith, Ltd., Montreal, Quebec

shapes of mounted wheels are available in this soft rubber polishing material.

According to the manufacturer, time required in the finishing of tools, dies, jigs and fixtures with portable equipment is greatly reduced by the use of the "Chicago" Improved Soft Rubber Polishing Wheel. No special equipment is said to be required in using the wheel, which is available in a complete range of sizes, including sticks and sheet form for hand lapping. Conventional dressing tools can be used to dress the face of the wheel to any desired contour so that irregular shaped castings can be polished with ease. Any coolant which is not a solvent of rubber may be used in connection with the wheel where desired.

### Weldon Roberts "Brightboy" Discs, Lathe Wheels, and Tablets

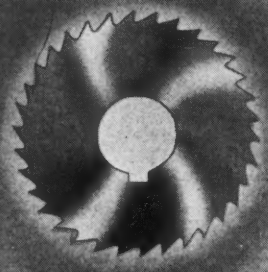
Weldon Roberts Rubber Co., Newark, N. J., is now marketing a line of "Brightboy" Discs, Lathe Wheels, and Tablets for finishing, pre-finishing, polishing, and pre - polishing metals.

Brightboy is a rubber-eraser compound impregnated with abrasive. The soft rubber binder cushions the abrasive




Weldon Roberts "Brightboy" Discs, Lathe Wheels, and Tablets

and gives to Brightboy a utility which lies between that of a light grinding wheel and a buff. In operation, the abrasive recedes into the resilient rubber, falling free as the binder is worn away. The light abrasive action produces a smooth, polished or pre-polished surface.



**CIRCULAR  
SAWS**

TRADE MARK  
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Made in high speed steel — 1/4" to 10" diameter.  
Also special saws.

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**CIRCULAR TOOL CO., Inc.**  
767 ALLENS AVENUE • PROVIDENCE, R. I.

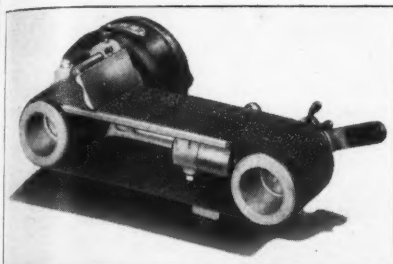
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Productive capacity wanted by a company holding large defense contracts. Must be able to manufacture small metal parts requiring high degree of precision. Especially interested in profiling and milling capacities; also interested in purchasing well equipped metal working plant with going business, or will buy entire lots of machinery. Address:

**Dept. 8-E, P. O. Box 26**  
**Trinity Station, New York City**

compound  
the soft  
abrasive



## NEW ABRASIVE BAND GRINDER..

"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with ALEMITE LUBRICATION complete with grease gun.

Write for illustrated folder on this and other styles and sizes.

**HORMEL-M GRINDER**  
WALLS SALES CORP.

96 WARREN ST. NEW YORK, N. Y.

Lathe

which  
grinding  
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at rub-  
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## U. S. HEADS

STANDARD SINCE 1915



Two Spindle Head  
Both Spindles  
Adjustable

The United States Drill Head Co.

1954 Riverside Drive  
CINCINNATI, OHIO

## An Advanced Boring Mill—

Yoder extensive manufacturing resources applied to the production of one popular size boring mill has attained the seemingly impossible—ability to assure deliveries in a fraction of the time now generally required.

Investigate this machine at once. You will be pleasantly surprised at its versatility, simplicity and convenience of operation.

Number 5 Morse Taper 24 inch traverse of bar. 24" x 48" table. 3" bar. 5 H.P. Motor.

All adjustment dials are easily readable. All controls are within convenient reach. All practical safeguards are provided. Milling cutters can be attached to spindle flange.



Reflecting LAMBERTS years of experience  
Built to YODER high standards of excellence

**THE YODER COMPANY**

CLEVELAND, OHIO

Originators and Manufacturers of METAL WORKING EQUIPMENT

1941

June, 1941

MODERN MACHINE SHOP 255

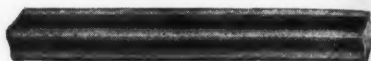
On most metals, minor blemishes can be erased by the application of Brightboy in one of its various forms. Brightboy removes oxide film from aluminum alloys prior to welding, smooths away burrs and rough edges on die stampings, or produces a mirror finish on hard steel dies. It is also said to restore a No. 4 finish to stainless steel at soldered or welded joints. In addition, Brightboy cleans and polishes edged tools. In precision work, it is said to function with minimum dimensional loss to material.

Because the binder is soft rubber, no

special tools are required to dress a Brightboy wheel, and any desired surface can be formed for special use. A worn-out tool or even an old file is said to serve as a means for facing a Brightboy wheel for use on concave, convex, or stepped surfaces.

### "Flutagon" Non-Tempering Tool Steel

Atlantic Steel Co., 1775 Broadway New York, N. Y., is now offering a non-tempering tool steel in bars of approxi-



"Flutagon" Non-Tempering Tool Steel

mately square shape with rounded corners, which is identified as "Flutagon." The steel when drawn into chisels, punches, cutters, blacksmith tools, and so on, will not roll off workbenches or tapering surfaces onto the ground.

### "Pacific" Positive Offset Boring Head


The positive offset boring head shown in the illustration herewith, product of the Pacific Tool & Supply Co., 344 N. Vermont Ave., Los Angeles, Cal., is a sturdy and compact unit designed to withstand severe usage. The head embodies a means for checking whereby two hardened buttons provide a positive check before the required hole is cut. One button is attached to the stationary



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WITH  
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**FOR DEFENSE --- AND YOUR SECURITY USE**  
**KARELSEN —**  
**Diamond Pointed Emery Wheel Dressers**  
1/4 kt. to 10 kt.  
Send for prices IMMEDIATE SHIPMENT Specify holder

**E. KARELSEN, INC.** ESTABLISHED 1852  
56 W. 45th ST., NEW YORK, N. Y. TEL. VAN. 6-5688

## Mark It Quickly with a **NUMBERALL**

Made with 1 to 10 wheels.  
Stamp in perfect alignment.  
Shank for Hand or Press  
Stamping. Platform for stamping  
Name Plates and  
other small  
articles.

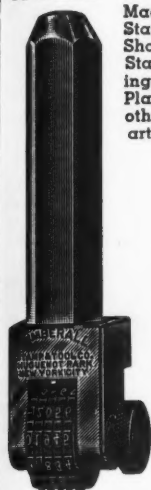
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Platform



**NEW Quick Set Machine.** One wheel can be turned quickly by knurled knob for consecutive numbering.

**NUMBERALL STAMP  
& TOOL CO.**

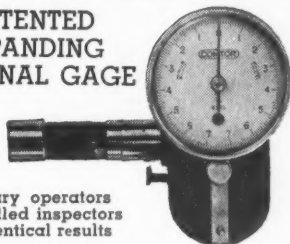
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Any man can use it  
with positive accuracy  
to fraction of .0001".

## **COMTORPLUG**

**PATENTED  
EXPANDING  
INTERNAL GAGE**



Ordinary operators  
and skilled inspectors  
get identical results

Shows actual size of bore to fractional  
ten-thousandths. Detects front or back  
taper, out of round, barrel shape, etc.  
No training needed to operate. Sizes  
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REQUEST BULLETIN 27

**THE COMTOR CO.**  
WALTHAM, MASS. EST. 1928

## **WELDON END-MILLS**

MADE BY

**"YESTERDAY'S PIONEERS — TODAY'S LEADERS"**



**CAREFUL SELECTION OF MATERIAL.**

**PRODUCTION ON MODERN EQUIPMENT.**

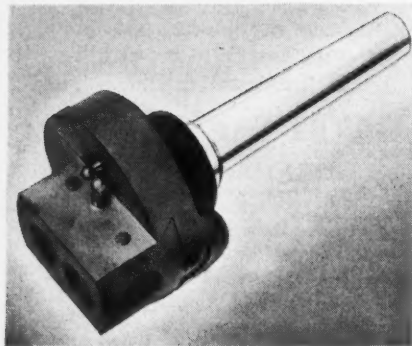
**HEAT TREATMENT IN OUR OWN PLANT.**

**MORE THAN TWENTY YEARS EXPERIENCE  
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**ALL THIS HELPS TO INSURE A QUALITY IN OUR  
ENDMILLS WHICH MEANS SATISFACTION TO YOU.**

SEND FOR OUR No. 8 CATALOGUE.

**THE WELDON TOOL CO., • 3000 Woodhill Road, Cleveland, Ohio**



"Pacific" Positive Offset Boring Head

portion of the head and the other button to the moving or adjustable part of the unit. One button has a flat side and the other button is completely round. By checking across these two buttons with a micrometer before any cutting is done, an absolutely reliable reading is said to be obtained, thus eliminating any chance for costly errors.

The boring capacity of the head is 0

to 15 in. Boring bar hole size is 1 in. The outside diameter of the boring head is  $4\frac{1}{8}$  in. and the overall length without shank is  $3\frac{1}{2}$  in. Standard shanks available are B & S No. 9, 10, 11, and 12 and Morse No. 4. Straight shanks for turret lathes are also available.

### Rusnok Model ST Quill Type Milling Attachment

Rusnok Tool Works, 1845 W. Carroll Ave., Chicago, Ill., announces a milling attachment having a movable quill especially designed to provide capacity for heavy duty milling or boring operations. The attachment, which is designated as the Model ST, is fully universal and utilizes a range of end mills from  $\frac{1}{8}$  to  $\frac{3}{4}$  in. for cutting all grades of steel.

The Model ST employs a large size spindle which is hardened and ground and has a No. 9 B & S taper for standard end mill holders. The spindle operates in precision tapered roller bearings and is driven by a six-splined pulley drive. The large diameter quill is

**FOR MODERN METAL CUTTING TOOLS**

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**NATIONAL TWIST DRILL & TOOL CO., Detroit, U.S.A.**

TWIST DRILLS • REAMERS • HOBS • MILLING CUTTERS • COUNTERBORES • SPECIAL TOOLS

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**PUNCHES CUTTERS  
BENDERS  
SPECIAL TOOLS**

PUNCHES and DIES for round, square and other shaped holes. Catalog sent on request.

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Wickersham 2-7164**



### Here's a Real Spring Winder!

- No. 1 Capacity 0 thru  $3/32$ " wire, \$1.25
- No. 2 Capacity 0 thru  $3/16$ " wire, 2.50
- No. 3 Capacity 0 thru  $5/16$ " wire, 5.00



**Will Earn Its Cost In One Day**

The HJORTH Perfection Spring Winder offers the ideal means of winding extension, compression, torsion, taper, double taper, or left hand springs. Try one in your shop. You'll like it and the price is reasonable.

**HJORTH LATHE & TOOL CO. 12 BEACON STREET WOBURN, MASS.**



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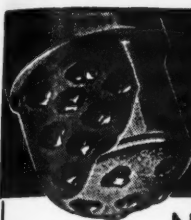
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**Free Cutting!  
Non-Glazing!  
Abuse Proof!**

## New WTTCo Diamond Impregnated WHEEL DRESSER

Whole, unbroken diamonds of high quality and extreme toughness are spaced regularly throughout the matrix to give great accuracy, uniform dressings and to hold wheel to size. These stones are anchored permanently in their matrix by strong chemical bonds that will not break under heat, pressure or rough abuse. No re-mounting! Lowered production costs!

*Send for literature and prices.*

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3200 W. Davison • Detroit

In Canada: 575 Langlois, Windsor, Ont.

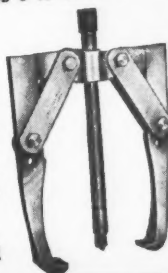
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### CUT PRODUCTION DELAYS

Conserve time and man power, reduce accidents — with OTC GRIPOMATIC PULLERS. Automatic grip prevents slipping. Capacities 5 to 50 tons.

#### OTC PULLING SYSTEM

Includes Pushers and Pullers to install or remove gears, bearings, wheels, pulleys, sleeves, shafts, etc. Write for Plant Maintenance Bulletin.



**SPECIAL TOOLS**  
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AUTOMATICALLY COMPENSATED FOR

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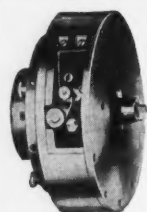
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### With Automatic Feed

Can be attached to Column Boring Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically and covers faces 6" to 30".

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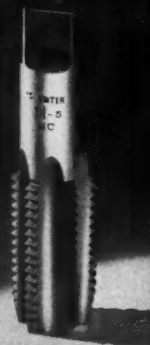
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Any Quantity  
AT THE RIGHT PRICE

**THE CINCINNATI GEAR CO.**  
1825 Reading Road Cincinnati, Ohio



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Manufacturers of  
Hand, Machine  
Screw, Chip Driver,  
Pipe, Nut, Stove  
Bolt, Boiler, Pulley,  
Staybolt, Tapper  
Taps, Serial Sets,  
Interrupted Thread,  
High Speed and  
Alloy Steel Taps,  
Ground Thread  
Taps.

Also a complete  
line of Round Ad-  
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## THE WINTER BROTHERS COMPANY

WRENTHAM, MASSACHUSETTS  
BRANCH FACTORY: DETROIT, MICH.

A DIVISION OF THE NATIONAL TWIST DRILL  
& TOOL CO., DETROIT, MICH.

also hardened and ground and lapped to a close sliding fit in the housing. Particular attention has been given to the design and construction of the spindle and quill to ensure smooth cutting, free from chatter and vibration.

Feeds for a 4-in. quill travel are pro-



Rusnok Model ST Quill Type Milling Attachment

vided by a lever, adjustable to several positions, for a quick rack feed, and by a handwheel for a fine worm feed. The worm feed can be engaged or disengaged with the quill in any position. Both the handwheel and the lever are removable when not in use. A locking micrometer depth stop and positive

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## CONTINUOUS HINGES



Manufactured by

**AUTO MOULDING  
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2326 S. CANAL ST.

CHICAGO

WRITE FOR STOCK LIST

## FOR HIGH SPEED TRAINING

USE...

### ADVANCED MACHINE WORK

12th EDITION



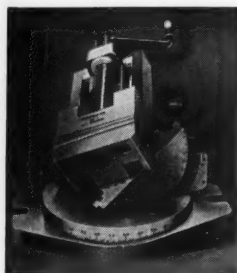
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Unrivalled as the complete textbook on  
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Universal Vise



Universal Angle Plate

## For Fast, Accurate Set-Ups

### The WESSON <sup>all steel</sup> UNIVERSAL VISE

Gives you faster set-ups and greater accuracy. No more tedious or makeshift measuring. Accurately graduated in all planes. Sturdy cradle design and all-steel construction give greater rigidity; permit faster stock removal. Two sizes, priced for every shop. Can be furnished with slotted surface plate for use as universal angle plate. SEND FOR FREE FOLDER.

**WESSON CO.,**

**Ferndale, Michigan**

Please send me illustrated Folder covering the Wesson Universal Vise.

Name .....

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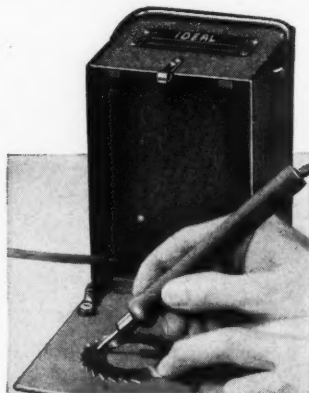
quill lock are also features of the Model ST attachment.

A  $\frac{1}{2}$  h.p., 1,725 r.p.m. motor is used to power the attachments and is mounted separate to facilitate easy handling. Six different speeds ranging from 250 to 3,000 r.p.m. can be obtained.

### Ideal "Thin Line" Electric Etcher

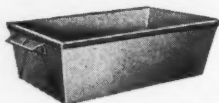
A small, inexpensive electric etcher for permanently marking small tools and parts has been announced by the

Ideal Commutator Dresser Co., 1031 Park Ave., Sycamore, Ill. As its name "Thin Line" implies, the etcher writes with a fine line, burning the mark, identification number or name into the metal so that it cannot become blurred or



Ideal "Thin Line" Electric Etcher

### New Nesting Type Tote Pans

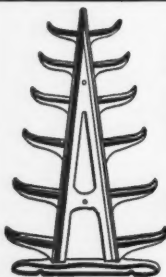


20" long x 12" wide x  $6\frac{1}{2}$ " deep.  
16 ga., drag holes and handles both ends.

**J. L. LUCAS & SON, INC.**

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### "CHAMPION" Steel Racks

Save time, steps and money by keeping bar stock, shafting and pipe out of the way and off the floor.

Write for full details.

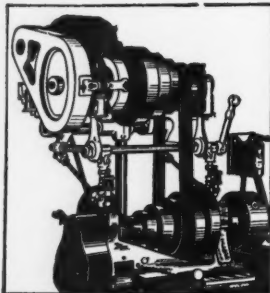
**THE WESTERN TOOL & MFG. CO.**

Springfield, Ohio

worn off with ordinary usage. All parts are fully enclosed and out of the way when not in use.

Tools, parts in production, and finished products made of iron, steel and their alloys, which are to be marked, are placed on the work plate inside of the cover. The etcher tool is then held in the hand and used as if writing with a lead pencil.

The complete unit includes 9-ft. primary lead and plug, 2-oz. heat-resisting hand piece with 3-ft. lead, 4 x 6-in. work plate, 115 volt, 50-60 cycle standard. Other voltages and frequencies are available. Etching heat, 125 watts. Wt.,  $5\frac{1}{4}$  lb. Size,  $4\frac{1}{4}$  x  $4\frac{1}{4}$  x 7 inches.



## Cuts Cost In Half!

Remco Motor Drives deliver power when, and where, it is needed. Show tremendous production increases, with power savings up to 50%. Eliminate costly maintenance of shafting, pulleys, clutches and belting. Improve lighting! Increase safety! Reduce noise! Save floor space! Low installation cost! Investigate—write! Remco Products Corp., State and Hay Sts., York, Pa.

### REMCO MOTOR DRIVES

for LATHES, SHAPERS, DRILLS, MILLING MACHINES, etc.



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we will send you a  
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KOEBEL DIAMOND TOOL CO.  
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Multi-Point, Multi-Set, Multi-  
Edge, and Single Set. Diamonds for  
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### DROP FORGED STEEL

Standardized Die Sets, embodying many  
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195,000 stock sizes and 46 different  
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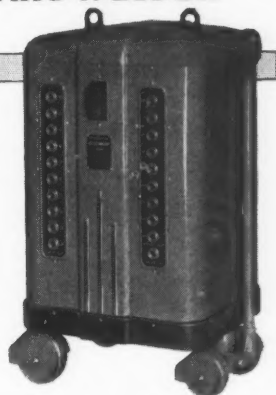
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1806 S. Kilbourne Ave.

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Now, more than ever, industrial  
America is called upon to operate at  
top most efficiency. The fabrication  
of jigs, fixtures, tools and dies must  
be done quickly, efficiently and eco-  
nomically.

Production men, the country over,  
are turning to the new Marquette to  
solve their maintenance problems.  
On the spot repairs without the need  
of dismantling machinery reduces  
lost time to the minimum. It's the  
new Marquette for economy and the  
new Marquette for efficiency.

**BUY THE BEST... BUY MARQUETTE**

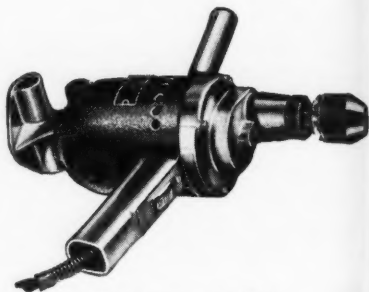
**MARQUETTE**  
MANUFACTURING CO., INC.  
MINNEAPOLIS, MINN.

## Speedway 1/2-In. Drill

The illustration shows the Speedway 1/2-In. Drill which has been placed on the market by Speedway Manufacturing Co., 1863 S. 52nd Ave., Cicero, Ill. The feature of the drill is the natural grip breastplate handle which, by producing a more direct application of power (applying thrust directly behind the drill point), is said to increase the accuracy and speed of drilling operations.

The drill, which is a high powered electric tool light enough for portable use yet heavy enough to stand up to

production drilling, has a powerful, specially wound, high torque back geared universal Speedway drill motor, self-aligning oilless bearings, forced air cool-



Speedway 1/2-In. Drill

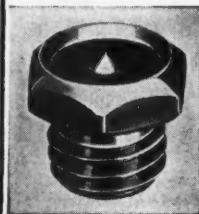


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### Accurate Hole Transfer Made Easy With NIELSEN TRANSFER SCREWS



Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 7 sizes U.S.S. Inexpensive — Last for years. Write for Circular

**NIELSEN TOOL & DIE COMPANY**  
1863 Gardner Ave.  
Berkley, Mich.

## Scherr Comparitol-Inspectoset Unit

The George Scherr Company, 130 Lafayette St., New York, N. Y., has brought out the Scherr Comparitol-Inspectoset Unit designed especially for shops now engaged in the production of parts to very close tolerances. The unit is said to enable any shop in which it is used to maintain complete control over all shop gages, mass produced parts, ball bearings, pins, and other parts.

Included in the unit is the Comparitol

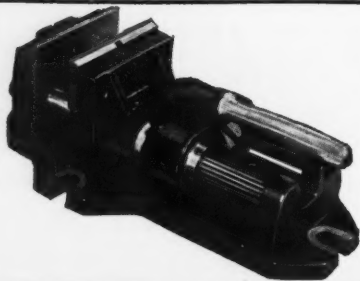
## Quick-Acting PRESTO - VISE

Sliding jaw is moved up to work with lever in raised position. Lever is then pressed downward to exert desired pressure on part being clamped. To release, lever is raised which disengages clutch and slide moves away from work. Write for complete details.

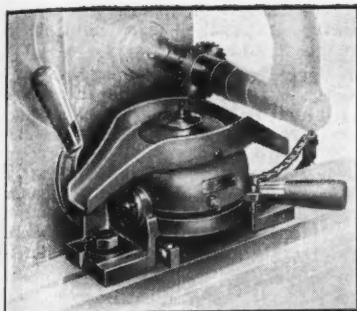
**D. A. SMITH & CO.**

8097 LIVERNOIS

DETROIT, MICH.







## DEARBORN Automatic Chucking and Indexing Fixture MILLS OVER 1000 PARTS PER HOUR

Work held by draw in collets. Collets open and close automatically. Work automatically ejected. Indexes without loss of time for milling 1, 2, 3, 4, 6, 8, 12 or 24 sided pieces. Minimum set-up time required. Speeds up production. Positive and accurate in operation.

**J. W. DEARBORN**  
70 S. CLIFF ST. • ANSONIA, CONN.

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**HASSALL**  
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NO. 40

*Special*  
NAILS  
RIVETS  
SCREWS  
COLD FORGED PRODUCTS

Write Today  
**JOHN HASSALL, INC.**  
CLAY AND OAKLAND STS.  
BROOKLYN, N.Y.

## GET THESE FOLDERS —

they may  
save your  
shop many  
man-hours



**CERROMATRIX**—simplifies die construction, anchoring machine parts, making chuck jaws, and many other applications.

**CERROBASE**—simplifies reproducing master patterns, proof casting molds, electroforming, and many other applications.

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## CERRO DE PASCO COPPER CORPORATION

40 WALL STREET

NEW YORK, N. Y.

BRITISH ASSOCIATES: MINING & CHEMICAL PRODUCTS LTD., LONDON  
CANADIAN DISTRIBUTORS: DOMINION MERCHANTS LTD., MONTREAL



Scherr Comparitol-Inspectoset Unit

which is graduated to read to 0.0001 in. plus and minus 0.002 in., and the Ultra-Chex Inspectoset consisting of 34 gage blocks which will make up all combinations in steps of 0.0001 in. from 0.300 to 8 in. The latter is furnished in a special-

ly designed polished case to hold the Inspectoset and other gages.

In operation, the Comparitol is set with the Ultra-Chex in the Inspectoset, after which parts can be checked quickly and easily to 0.0001 in. by unskilled help. The Scherr Comparitol-Inspectoset Unit has been designed to eliminate rejections and disputes over measurements, and to guarantee precision accuracy in interchangeable manufacture and farming out under the defense program.

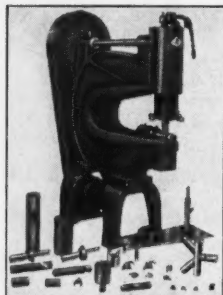
### Federal Wonder Cutter

The Federal Foundry Supply Co., 4604 E. 61st., Cleveland, Ohio, is now manufacturing a sturdy and compact cutting device for use in foundries, machine shops, steel mills, or wherever rods, wires, or band iron are used. Designated as the Wonder Cutter, the unit can be used to cut all types of hot-rolled rod and wire up to  $\frac{5}{8}$  in. round or  $\frac{3}{4}$  in. square and band iron up to  $\frac{1}{4}$  x 2 in. Powerful leverage assures easy operation.

The Federal Wonder Cutter has an

### SAVAGE NIBBLING MACHINE

FOR TUBE SLOTTING AND TUBE SHAPING—  
FOR FAST AND ACCURATE CUTTING OF  
FLAT SHEETS BY TEMPLATE OR TO A  
SCRIBED LINE.



Showing Tube Cutting Attachments and Samples of Work

Manufactured by

**W. J. SAVAGE COMPANY**  
KNOXVILLE Since 1885 TENNESSEE  
Pioneer Manufacturers of Nibbling Machines

**Cutting Capacities**  
Flat Sheets Mild Steel  $\frac{3}{4}$ "  
Tough Alloys  $\frac{1}{2}$ "

**Tubing**  
Wall thickness to  $\frac{3}{8}$ "  
1" I.D. to 36" O.D.

**Throat Depth**  
9" to 36"

Ask for BULLETIN "F"



Wiregrip Belt Hooks have patented blue aligning cards that hold hooks in exact position—assure uniform tension, and prevent card end waste—every hook is used.  
**ARMSTRONG-BRAY & CO.**  
"The Belt Lacing People" • 303 N. Loomis St., Chicago

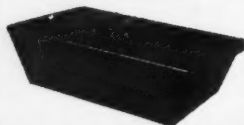
**STEELGRIP** (applied with a hammer) clinches into a smooth flexible joint compresses belt end. Double rocker pins take up wear. Write for catalog.



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ACCURACY—PROMPT SERVICE  
**Commercial Centerless Grinding Co.**  
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## TAPER PANS



16 gauge steel; one-piece all welded construction. Hook handle at each end. Standard size 12" x 20" x 6".

85¢ ea. any quantity, immediate shipment from stock, F.O.B. Philadelphia.

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## GERSTNER Tool Chests Serve Best



They give proper care to the good tools of the machinist and tool-maker. Good mechanics will do better work when tools are given care in a Gerstner Chest.

Free Catalog.

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—in the finer Pitches—14 to 96 D. P.

**SPURS WORM-  
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A few pieces or a million.*

You can **SAFELY** entrust your Gear purchases to this exceptionally well equipped and organized plant.

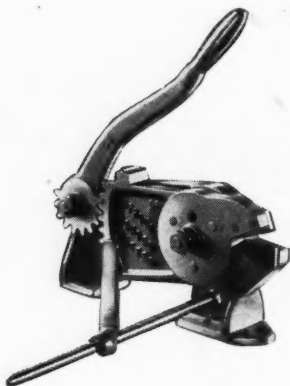
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**Gear Specialties**

2620 W. Medill Ave. Phone - Humboldt 3482

CHICAGO

adjustable stop gage which permits repeated cuts to the same length and is equipped with hardened alloy steel cutters for long life. The stop gage can be set for either wire or band iron of any

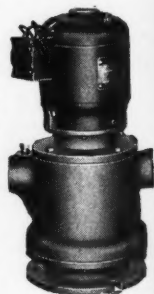


Federal Wonder Cutter

size within the capacity of the machine. The machine is 15 in. long, 18 in. high to top of handle, and 5 in. wide.

## Brady-Penrod Coolant and Circulatory Pumps

Coolant and circulatory pumps having hydraulic efficiency as high as 70 per cent are now being produced by Brady-Penrod, Inc., Muncie, Ind. The high efficiency is obtained by elevating hydraulic shock as the liquid travels through the pump. The design employs a Venturi impeller inlet, constant velocity vane curvature, progressive volute and orifice conversion discharge throat.



Brady-Penrod Model No. 100 Coolant and Circulatory Pump

The Brady-Penrod Coolant and Circulatory Pumps are available in five different models. They can also be made to individual design on order. Model No. 100 pumps are self-priming

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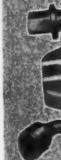


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for vertical mounting; pumps need not be submerged since they will pick up their prime. Model No. 200 pumps are self-priming for side wall bracket mounting. Since the pumps have ample suction lift, they can be mounted in any convenient location above the liquid level.

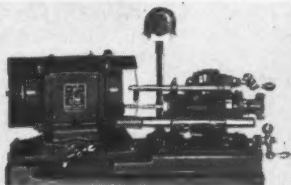


Brady-Penrod  
Model No. 300  
Coolant and  
Circulatory Pump

Model No. 300 pumps are flange-mounted, with suction in flange, for mounting on side of oil reservoir. The discharge pipe is radial, with location changeable within 90-deg. angle. Model No. 400 pumps are motor-foot-mounted, with center suction and 90-deg. changeable radial discharge. These pumps can be mounted in any position. Model No. 500 pumps are of the vertical pedestal type for submerging in a liquid reservoir and have various heights to suit liquid level.

Each pump is powered by means of a

## J-B TAP GRINDER



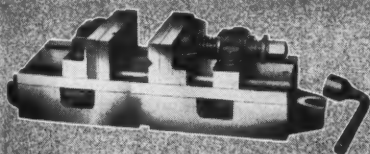
Taps sharpened on the J-B TAP GRINDER retain their accuracy and last longer.

You can sharpen right or left hand taps (2, 3, 4 or 5 flutes) uniformly on the chamfer... grind any taper or angle of chamfer desired... accurately set or quickly change amount of relief.

Write for Folder

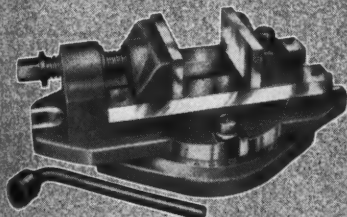
**EDWARD BLAKE CO.**

634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.



### HEAVY DUTY VISE

A 6" vise with double the capacity and durability of ordinary machine vises.



### GENERAL PURPOSE VISE

A 4 1/2" vise furnished with or without swivel.

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### Modern MACHINE VISES

With Hardened and Ground Working Surfaces

Semi-steel cast base reinforced with hardened and ground wearing plates which makes vises practically indestructible. Extra large capacity. Front and rear jaw adjustable on hardened working surfaces. Special means to secure locking on rear jaw. Heavy Acme Thread Screw.

Prices no higher than old style cast iron vises. Get the best to insure safety, accuracy and long life.

Prompt shipments on all vises.

Write for Bulletin No. 35.

### THE PRODUCTO MACHINE CO.

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3017 Medbury Ave.,  
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Manufacturers and Distributors of Producto Die Sets, Die Makers' Accessories, Dickerman Automatic Press Feeds.



$\frac{1}{8}$  h.p. motor which is designed to eliminate wear on the pumps and is suitable for use with abrasives. Equal efficiency is said to be maintained whether pumping water or light oil.

Pumps in each model are available with ratings established at SSU 400, 750, 1,250, and 2,000, which correspond to SAE 10, 20, 30, and 40 at room temperatures. NEMA motors with 20 per cent surplus power are used. The pumps are built in all models for capacities from 4 to 100 g.p.m., with heads up to 100.

**Special Anti-Mushrooming  
Anti-Chipping Heat-treat**

**Oversize Shanks ▶**

**Exclusive  
Knurled Back ▶**

**Exclusive  
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**Broach-  
Rounded ▶  
Corners**



**and  
a  
complete  
line of  
Marking  
Devices**

**Write for Price and  
Data Bulletin No. 113-12.**

**NEW METHOD STEEL  
STAMPS, Inc.**

**149 Joseph Campau, Detroit**

## Hygrade Miralume F-235

Designed to provide large quantities of light to aid working efficiency in industrial plants, the Hygrade Miralume F-235 shown in the illustration has been placed on the market by the Hygrade Sylvania Corp., Ipswich, Mass. The unit is supplied complete with two 100-watt fluorescent lamps and has a lumen out-



Hygrade Miralume F-235

put of over 8400, thus permitting wide spacing of units as well as making the Miralume ideal for mounting near the ceiling in high-studded areas.

The reflector of the unit is easily demountable. It is drawn from a single piece of 20 U.S. gauge metal and has a smooth, porcelain enameled, highly efficient reflecting surface. Working parts of the F-235 are carried in a housing which is connected to the top of the reflector by means of a latch assembly having no bolts. Four captive latches enable the reflector to be safely, easily, and quickly removed for cleaning.

The Hygrade Miralume F-235 is equipped with Hygrade's patented Mirastats, which are said to ensure positive starting and restarting. The Mirastats are so located that they can be easily reached, thereby making it possible to



## If it's STUD SETTING—It's our SPECIALTY

We can supply the proper tool for all sizes and types of stud setting—from 4-40 to 3" and larger if needed. Tools that are designed for small lots or large, for all standard and special types of studs, electric, pneumatic, machine tool or hand drive.

**Send us a sample stud or sketch  
• for practical suggestions •**

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## GITS Oilers



• Your lubrication problem, whether large or small, will find the correct answer in the Gits Line. If your requirements are of special nature, send us your specifications.

### GITS BROS. MFG. CO.

10 years of oil cup experience

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**QUICK DELIVERY**  
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## COLONIAL DRILL JIG BUSHINGS

## BUTTERFIELD TAPS



Compare Butterfield Taps with other taps for long life and cost per accurately threaded hole. The difference will reveal the superiority of Butterfield Taps and their profit possibilities.

**COMPARE  
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### UNION TWIST DRILL CO. BUTTERFIELD DIVISION

Factories: DERRY LINE, VERMONT, U. S. A.  
Athol, Mass.; Mansfield, Mass.;  
Rock Island, Quebec, Can.

**STORES:**

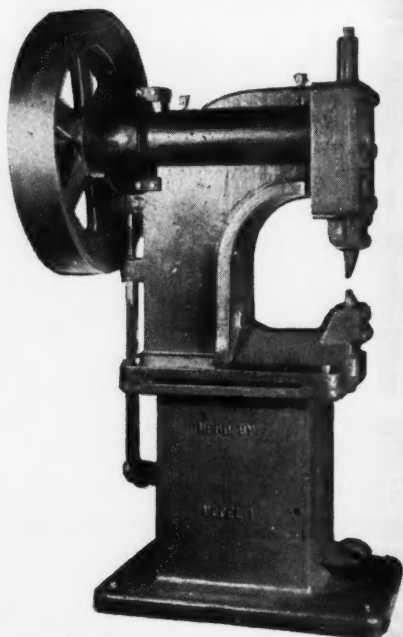
Cleveland	3346 Superior Ave.
Chicago	11 S. Clinton St.
Detroit	6540 Antoine St.
New York	61 Reade St.

remove or replace starters by a twist of the wrist without moving the lamps. The F-235 is supplied completely wired and assembled, corrected for power factor, equipped with Hygrade's Dua-Lamp Auxiliary, and approved by Underwriters' Laboratories, Incorporated.

## Scully-Jones Power Sprue Cutters

Scully-Jones & Co. (Foundry Div.), 1901 S. Rockwell St., Chicago, Ill., is now manufacturing and distributing the power sprue cutters formerly supplied

by Tessmer Machine & Tool Co., Detroit, Mich. The new line of sprue cut-



Scully-Jones Power Sprue Cutter

ters will be offered in the same size range; Model "H,"  $\frac{3}{4}$ -in. capacity and Model "I,"  $1\frac{1}{4}$ -in. capacity.

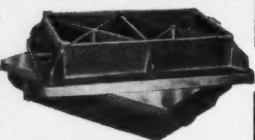
## "Redi-Edge" Diamond Tools

The Abrasive Dressing Tool Co., 1550 Broadway, Detroit, Mich., announces a "Redi-Edge" series of diamond tools

## REID Surface Plates

11"x15" 12"x18"  
18"x24" 24"x24"  
24"x36"

Properly Heat Treated, Thoroughly Seasoned. Write for Complete Price List.



Some Territories still open for dealers.  
**Tool Engineering Service Co., Inc.**  
243 Washington Ave. Nutley, N. J.

AVAILABLE  
IN ANY STYLE  
OR SIZE HOLDER

8 TO 16 NATURAL  
BORAZ STONES PER  
CARAT IMBEDDED IN  
TUNGSTEN ALLOY MATRIX



## SUPERSET DIAMOND WHEEL DRESSER

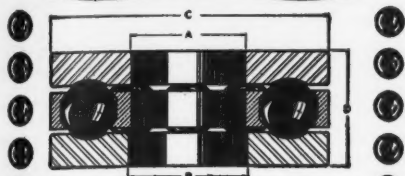
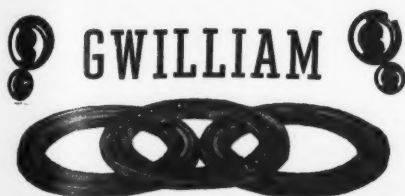
- **ECONOMICAL**—All Diamond Stones used completely up without loss or resetting.
- **EFFICIENT**—Several Cutting Points in contact with wheel at all times.

1-CARAT DRESSER 16 stones per carat for wheel Dia. 6" to 12"  
2-CARAT DRESSER 12 stones per carat for wheel Dia. 12" to 24"  
4-CARAT DRESSER 8 stones per carat for wheel Dia. 24" to 36"

Send for Circular and Prices!

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*Precision*  
**GEARS**  
ANY MATERIAL  
30 YEARS' EXPERIENCE  
**DETROIT BEVEL GEAR CO.**  
8130 Jos. Campau Ave. • Detroit, Michigan

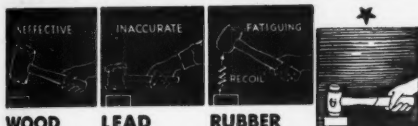


### TYPE GB GROOVED RACES BALL THRUST BEARINGS

STANDARD SIZES OR SPECIAL DESIGN to your specifications; send sketch or worn sample, regardless of condition, for quotation, without obligation. • Our complete catalog will help you in making selection of bearings—shall we send it?

## THE GWILLIAM CO.

359 Furman St., Brooklyn, N. Y.



### WOOD LEAD RUBBER

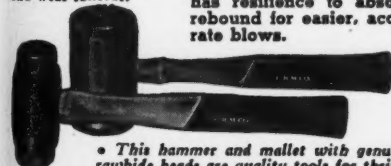
**WOOD** makes a clumsy tool that will split and crack.

**METAL** has edges that turn, break and fly off.

**RUBBER** makes a bouncing head that chips and smears.

**RAWHIDE** heads and faces stay accurate, absorb shock and wear longest.

• Chicago Rawhide Hammers and Mallets are the tools for striking hard accurate blows safely on any surface that must not be cracked, battered or marred. The tough Java Water Buffalo hide, coiled, compressed and treated for long life will not split, break or even dent, and has resilience to absorb rebound for easier, accurate blows.



• This hammer and mallet with genuine rawhide heads are quality tools for thrifty mechanics. Sold by industrial supply houses everywhere.

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For fine or coarse threading. Forming tools produce excellent results.

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For a wide range of work on lathes, shapers and screw machines.

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Threads close to a shoulder. Produces smooth, accurate threads.

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Spring feature allows faster feed with heavier cut. Cutter life is tripled.

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- No Damaged Work

Write for Details

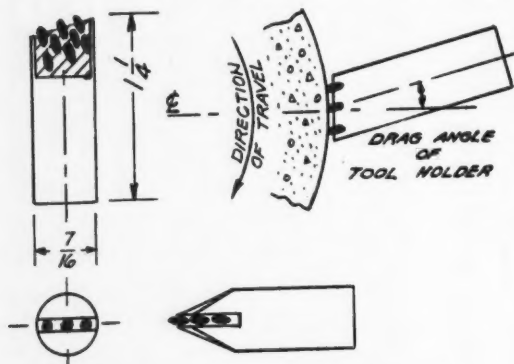


## AUTO ORDNANCE CORP.

1437 RAILROAD AVE.

BRIDGEPORT, CONN.

specially designed for large diameter form and radius dressing, as required on step and bevel edge wheels. The



Drawing Showing "Redi-Edge" Diamond Tool

Redi-Edge series is designed to combine the economy and durability of cluster tools with the sharpness and other wheel forming advantages of fine radius

dressers.

In the 8R type, eight diamonds are set in a single plane, forming a chisel edge.

The tracking action of the three stones in contact with the wheel simultaneously is said to produce a dressed finish similar to that produced by a sharp single stone.

Redi-Edge Tools are manufactured with the diamonds set at the drag angle of the user's toolholder. The tools are produced to operate efficiently on large diameter, wide-faced wheels with a keenness that is said to be ideal for fine corners and radii. They are particularly adaptable for special finishes on wheels.

Another type in the Redi-Edge series of diamond tools is the 8F, which is designed specifically for straight face and straight side dressing. The positioning and the type of diamonds employed produce fine wheel finishes essential to certain types of grinding, as in the case of crankshaft wheels.

# SpeedWay

**1/2" DRILL \$24<sup>50</sup>**



•Don't let the price fool you. This is a real full capacity industrial 1/2" drill—a handier, more powerful and all-around better drill than many costing a third more. Specially wound, high torque, forced-air cooled longlife motor. Improved design breast plate end handle—at last, a "natural grip" handle that applies thrust in a direct line with the drill point, and all the features common to other quality drills—oilless bearings, sliding thumb switch, streamlined die cast case, removable side handle, waterproof cord and unbreakable plug.

**SPEEDWAY MANUFACTURING CO.**  
1825 So. 52nd Ave., Cicero, Ill.

## G-E Splashproof Tri-Clad Motor

A line of Tri-Clad splashproof, ball bearing, polyphase induction motors in sizes from 1 to 15 h.p. has been announced by the General Electric Co., Schenectady, N. Y. The motors are especially designed to meet the requirements of applications where splashing water and other liquids are present, such as in industrial plants, laboratories, and so on.

The G-E Splashproof Tri-Clad Motor features functionalized styling, modern, streamlined appearance, and triple protection — protection against physical



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brings all adjustments under absolute micrometric control of the operator without stopping tool or machine. In Jig Borer, Milling Machine or Horizontal Boring Mill, it bores, faces, counterbores, turns outside diameters, mills flat surfaces and slots, under-cuts, recesses, back-faces and does an almost limitless range of "headache" jobs. Send for bulletins. Address all communications, inquiries and orders to

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Noiseless Spinning Riveters



2 to 6 Spindles

Head rivets from smallest to 3/16" diameter.

Built with automatic trip or foot operation.

Other types include Double-Spindle Horizontal and Single-Spindle Vertical Noiseless Rivet Spinning Machines, and Single-Spindle Vertical Hammer type Riveters.

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**GRANT MFG. & MACHINE Co.**

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## CHICAGO MOUNTED WHEELS OF V/T SUPER BOND

## 150% LONGER LIFE

V/T Super Bond is the most important development in mounted wheels in 30 years. Does work faster and better. Won't ridge on welds, sharp corners, sinking dies, barbering, etc.

**TRIAL WHEEL**—Tell us kind of job, type of equipment you use and size wheel and we'll send you one to try out.

**FREE CHART**—A Wall Chart 22 x 15" shows actual size and shape of every standard Chicago Mounted Wheel. Ask for one.



## HI-POWER GRINDER

For jobs beyond the capacity of the Handee, nothing compares with the HI-POWER in vibrationless performance, precision and stamina. 17,000 r.p.m. with ample power to drive a 2 1/2" diam. wheel. Wt. 3 lbs. In wood case with accessories, \$35.00.

## Handee Tool of 1001 Uses

Grinds, drills, polishes, cuts, routs, carves, sands, saws, sharpens, engraves, cleans, etc. Uses 300 accessories. 25,000 r.p.m. Wt. 12 oz. \$18.50 with 7 Accessories.



10 Days Free Trial

Send for catalog of complete line.

## CHICAGO WHEEL & MFG. CO.

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damage, electrical breakdown, and operating wear and tear. Outstanding features include a sturdy cast iron stator frame and end shields that are said to resist rust and corrosion, Formex wire windings which are highly resistant to moisture, and thoroughly protected ball bearings.

The ventilated openings of the stator frame and end shields are carefully baffled to block the entrance of splashing liquids. An ingenious arrangement of cast baffles within the side openings of the stator frame effectively blocks

splashing from the side.

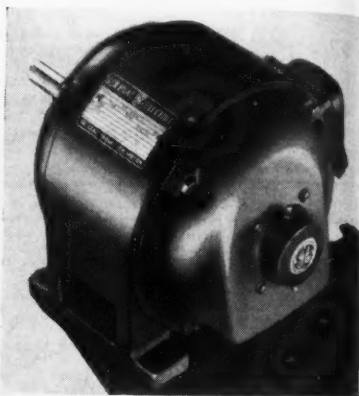
The windings of the motor are Formex, G-E's heat- and solvent-resistant magnet wire, carefully wound and impregnated with a special synthetic

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**SCHAUER**  
**Speed Lathes**

**Variable Speed**  
Ideal for lapping, filing, polishing small metal and plastic parts.  
Write for Catalog 400.

**Schauer Machine Co.**  
2060 Reading Rd.  
CINCINNATI, OHIO

G-E Splashproof Tri-Clad Motor

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**End Costly Guessing  
With this Dependable  
LANCE PYROMETER!**

Direct-reading—accurate within 2%—shows you correct temperatures for heat-treating, annealing, tempering, baths, solutions, etc. Prevents costly guess-work. For surface or immersion readings; portable; entirely self-contained. Low-priced; rugged; dependable.

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**RUSSELL ELECTRIC CO.**  
338-F W. Huron St. CHICAGO

**Hold-Heat Pyrometers**



Thermocouples  
\$1 to \$4  
extra.

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\$16  
10  
DAYS  
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TRIAL**

resin varnish. As a further protection the windings have a covering coat of Glyptal No. 1201 Red. Cast iron housings machined to close tolerances enclose the ball bearings for complete protection. The outer portion of each housing is part of the end shield itself, thus eliminating external joints and fits.

Ample space for making connections easily and quickly is provided by a liquid-tight cast iron conduit box.

**Elastic Stop Thin Hex Nuts**

For use on shear bolts where a high degree of the stress is lateral, and for general application to light and medium

**5000  
Shapes and Sizes  
Grobet Swiss Files**



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The most complete catalog of its kind. Lists 5000 different shapes, sizes and cuts of GROBET Precision Swiss files. . . . Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability.  
Ask also for catalog KM on Files for Filing Machines; catalog KR on Rotary Files and Diesinkers' Burs.

**GROBET FILE CORP. of AMERICA • 3 PARK PLACE  
NEW YORK CITY**

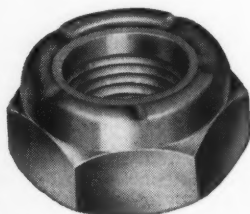
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stress fastenings, an improved line of thin hex nuts has been announced by Elastic Stop Nut Corporation, 2327 Vauxhall Rd., Union, New Jersey. The nuts are said to have approximately 40 per cent of the strength of



Elastic Stop Thin Hex Nut

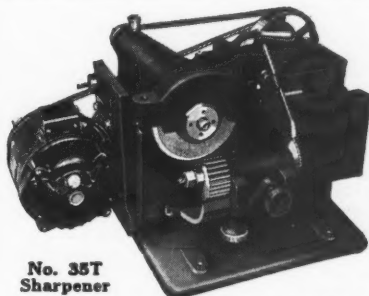
standard-height hex nuts and have been developed to meet the demand for a self-locking fastening which offers savings in space requirements, weight, and cost. An indication of their suitability is the fact that they are approved for use on aircraft by military and civil authorities.

As in the standard-height Elastic Stop Nuts, the self-locking action is accomplished by means of a vulcanized fiber collar which is built into the head of the nut. This tough, bone-like material resists the entry of the bolt, thus forcing the nut outward and taking up all thread play. The fiber, being non-metallic and of a resilient character, does not deteriorate under vibration and continues to hold the threads of the nut and bolt in a constant pressure-contact. The nuts are available in steel, brass, and aluminum, in a complete range of standard sizes, both coarse and fine thread.

## Stow Collet Chuck

A compact, single purpose collet chuck which can be quickly attached to handpieces used on Stow Flexible Shaft Machines has been brought out by the Stow Mfg. Co., Inc., 1 Shear St., Binghamton, N. Y. The chuck is furnished in two sizes, one with  $\frac{1}{4}$ -in. chucking capacity and the other with  $\frac{3}{8}$ -in. chucking capacity.

The Stow Collet Chuck is made two styles; namely, with a straight threaded, hex-head stud and with a tapered shank. With a straight



No. 35T Sharpener

## AUTOMATICALLY SHARPENS METAL SAWS IN GANGS

Up to 5½" diameter and up to 1¼" thickness. 100 SAWS of 26 GAUGE CAN BE SHARPENED AT ONE TIME.

The saws are automatically indexed and sharpened within a variation of plus or minus .001 of exact diameter of entire lot.

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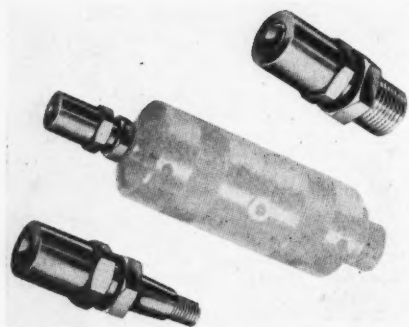
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**ROTARY FILES**  
Ground From the Solid



*Write*  
*for Catalog* **KG**

The most complete catalog of its kind, illustrating hundreds of rotary files hand cut, milled cut, ground from the solid; also countersinks and sinkers' burs.

**GROBET FILE CORP. of AMERICA • 3 PARK PLACE NEW YORK CITY**



Stow Collet Chuck

threaded, hex-head stud, the collet chuck is interchangeable with the clamp spindle on the standard handpiece. With a tapered shank, it fits into the tapered socket of the high speed handpiece, a type used with rotary files, mounted points, or other high speed tools, to assure true running on precision work. The tapered type of collet chuck will also fit a tool post attachment for grinding operations with a lathe.

## A.C.M.I. Industrial Telescope

To meet the need for an efficient tool with which to inspect internal surfaces, recesses and hidden contours which ordinarily cannot be seen, American Cystoscope Makers, Inc., 1241 Lafayette Ave., New York, N. Y., has developed a line of industrial telescopes. These instruments are equipped with highly corrected lens systems and excellent lighting systems. They are readily adaptable to work of special nature or to routine inspections of large numbers of parts by means of simple fixtures.

The illustration is a drawing of the Type A industrial telescope, which is designed for right-angle inspection. The instrument is made with an integral lamp, the lamp being positioned ahead of the objective lens. The right-angle system provides vision at right angles to the axis of the telescope and provides a visual working area of about 1 in. at 1 in. from the objective lens. This instrument is the most useful and consequently the most generally used of the industrial telescopes.

The Type A instrument is made to facilitate inspections of the most inaccessible corners and internal surfaces.

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## THE HANDIEST RACK YOU EVER SAW

Greatest Capacity—Smallest Floor Space

4 arms, 51" high, stacks 10,000 lbs.; 5 arms, 57" high, 12,000 lbs. flat or round stock. 3 stands for 20' lengths; 2 for 12' or shorter. Use against wall or back to back in center of room. Cost is small, value big.

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WM. S. YOHE SUPPLY CO.  
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## Coupling Has Only 3 Parts

The resilient spider cushion and two metal end bodies make up this famous Type "IA" L-R non-lubricated flexible coupling. All sizes: 3/16" to 2 1/4". SAMPLE! Send H.P., R.P.M. and Shaft Diameter and get sample. Ask for free catalog.



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Micro  
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## LAY-OUT DYE

Manufactured by

MICHIGAN CHROME  
& CHEMICAL CO.

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Be Sure to Take  
Advantage of This  
Special

TRIAL  
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4 Handy Resonance Candles  
from Brush-to-Care. Used for  
shop use and for trial  
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It can be supplied for insertion into holes as small as two-tenths of an inch in diameter and in a wide range of lengths in the larger sizes. It is a perfect instrument for the examination of rifle and pistol barrels.

When used to inspect the finish in the interior of a rifle barrel or similar workpiece, the position of the lamp provides perfect illumination and reveals any surface flaws or irregularities, as the magnification in this instance is approximately 4X. In the majority of these telescopes the area in view is 1 in. in diameter at 1 in. objective distance. As the object is brought closer to the objective lense, the magnification increases in inverse proportion. An indicating button on the eyepiece shows the direction in which the objective lens is turned.

The A.C.M.I. industrial telescope is a precision-built optical system embodying a complex arrangement of prisms, achromatic and plain lenses through

which light is passed to the observer with maximum efficiency. The light source, located in front of or ahead of the objective lens, provides illumination



A.C.M.I. Type A Industrial Telescope

for the part under inspection. The ocular lens is in the opposite end of the telescope. A rotating contact prevents entanglement of lighting cords. Many months of service can be expected from the lamp and the replacement cost is negligible. All instruments are equipped with 6-ft. lighting cord, two extra lamps, and battery box. If desired, a 110 or 220-volt alternating current transformer may be used instead of the battery. The entire instrument is contained in a suitable maple case. The instrument is made in a variety of types to meet varied requirements.

## PRODUCTION WICACO CONTINUOUS OIL GROOVING MACHINE — VERY FLEXIBLE —



### FEATURES:

1. Upright construction of the spindle and stationary chuck permits continuous loading and unloading the work without stopping the machine.
2. Revolving spindle and stationary chuck permit grooving of large irregular pieces.
3. Automatic operating features enable unskilled labor to produce 500 or more pieces per hour. The WICACO Continuous Oil Groover is unequalled for production and profitable on both large and small quantities—extensively used in grooving bushings, connecting rods, universal joints, retaining rings, shafts, etc.

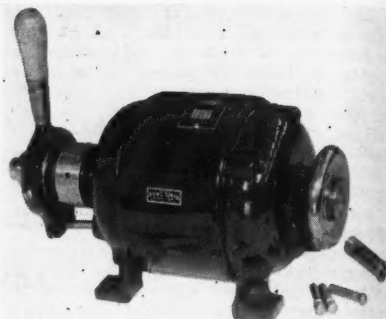
Also, Heavy Duty Horizontal Oil Grooving Machine.  
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**THE WICACO MACHINE CORP.**  
WAYNE JUNCTION Est. 1868 PHILADELPHIA, PA.

## C. W. C. Speedy Polishing Lathe

Realizing the need to free precision bench lathes for other uses, because of stepped-up production demands, the C. W. C. Corporation, Hawthorn, Cal., has placed on the market the Speedy Polishing Lathe shown in the illustration. The lathe is designed to finish turret lathe products, remove tool marks, polish round parts, as well as for lapping and burnishing.

An outstanding feature claimed for the C. W. C. Speedy Polishing Lathe is



C. W. C. Speedy Polishing Lathe

## The Tool for YOUR Production

Holds four individually set  $\frac{3}{8}$ " tool bits. Indexes quickly and accurately.



**The Presto Tool Mfg. Co.**

12234 Elmdale

Detroit, Mich.

its ability to hold automatically work having considerable variation in diameter without readjusting collet tension. The draw tube, being hollow, permits polishing of extremely long pieces.

## New Books

**Scientific Price Management I.** By Allen W. Rucker. Published by the Eddy-Rucker-Nickels Company, Cambridge, Mass. Bound in hard covers with plastic binding with six cellophane-surfaced two-color Calculator Charts and with a complete but brief explanatory text. Price, \$5.00.

Published for executives, sales managers, buyers and merchandise managers, production managers, auditors, and trade association officials, "Scientific Price Management I" is wholly unique.

In contrast to books based on the theory of prices and pricing, this book

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## STEVENS ROTARY TABLES STANDARD AND DIAL TYPES



Table graduated for single degree reading. Precision and accuracy. Thirty years' experience designing circular attachments.

Write for circular.

Four sizes; two types of each.

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## BOKUM Long Life Boring, Bottoming and Internal Threading Tools

for holes from  $\frac{3}{32}$ " up. Three types . . . twelve sizes. Real money savers for lathe, jig borer, screw machine or boring mill.

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Style A

Plain Boring



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Facing, Bottoming

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presents a direct realistic approach to everyday price problems. No less than 15 different types of such problems, taken from actual case studies by the author's firm of management counsel, give the user of this manual virtually a complete guide to pricing problems. The case studies range from simple price cuts to problems involving advertising allowances, freight allowances, and sales bonuses to which are added problems embracing added production required of factory employees to justify step-up differential piece rates, added retail store sales needed to warrant promotion of lower priced lines and increased volume necessary to justify "deals" and merchandise premiums.

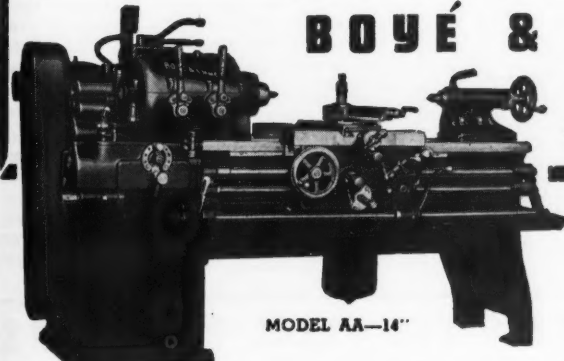
As the author points out, few know how to compute the added volume needed to compensate for price discounts or added direct costs. The volume requirements vary both with the percentage of price discount or cost increase and with the original gross margin of profit. Mr. Rucker had previously developed the price-volume compensation formulae for computing such volume increases; now, in "Scientific Price Management I" he provides the

means to determine volume increases under every possible condition without any computation whatever.

This is accomplished by the use of six Calculator Charts, 9 x 12 in. in size, printed in two colors on indexed bristol board and incorporated in the manual. To find, for instance, the added volume necessary to justify price discount of 25c, on an item, one simply consults a Calculator Chart and reads over the answer according to his individual margin percentage and percentage price-discount. "Scientific Price Management I" is a working manual for executives who must make decisions relative to prices or costs.

**Press Working of Metals.** By C. W. Hinman. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. 443 pages. Cloth binding, board covers. Price, \$4.00.

In this book, a well-known tool engineer and designer offers a new approach to the subject of press working of metals in that he emphasizes the principles of die designs rather than the lengthy details of individual press tools.



## BOYÉ & EMMES

# Lathes

**MODEL AA-14"**

Forty-five years of specialized manufacture are behind this line of heavy duty lathes. Made in a full range of

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sizes—from 14" to 36"—each of outstanding power, accuracy, range and economy.

**THE BOYÉ & EMMES MACHINE TOOL CO.**  
C I N C I N N A T I                      O H I O

The book contains a number of noteworthy features. There is a chapter illustrating and describing all the types of presses in common use. It contains special information about presses, taken from the author's long experience, and shows how to select the right type of press for any particular die job for either large or small work.

In the chapter dealing at length with the design and use of chutes, magazines, hoppers, roll feeds, and dials, the author tells how, when, and why these press tool auxiliaries should be used. The details of punch press accessories

and attachments and the methods employed in using them are fully described and illustrated.

The chapters on materials include two chapters giving the chemical and physical properties of ferrous and non-ferrous metals in regard to press work, one chapter devoted to press working of non-metallic materials, and one chapter on specifications for ordering sheet metals. The press working qualities and methods for testing sheet metals for workability in dies are discussed. The manufacture of cartridges and the principles involved in drawing ammunition shells are included for purposes of national defense.

A timely discussion covers some of the designing and drafting methods now in practice, the grade classifications of dies, nomenclature in die work, weights of materials per thousand blanks, gaging, estimating tool costs, and the total hourly labor and material costs of punch press products.

The book includes recent advances in the press working of aluminum, magnesium, and their alloys, stainless steel, the bronzes, Corronil, and several other alloys of metals. There are several hundred illustrations of practically all the types of press tools known to date. At the end of the book is an extensive treatment of low cost dies for limited production, novel die operations, and a review of the simple mathematical formulas used in computing press tools and presses.

**Sales Engineering.** By Bernard Lester. Published by John Wiley & Sons, Inc., New York, N. Y. 200 pages, 5½ x 8½ in. Price, \$2.00.

"Sales Engineering" is a "how-to" book outlining in detail the sales strategy, sales technique, and the special use

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#### THROATLESS SHEAR

- Cuts metal any shape.
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- Finest construction.
- Low Cost — Write today!  
No. 1—cuts 14 gage, wt. 16½ lbs.  
No. 2—cuts 10 gage, wt. 33 lbs.  
No. 3—cuts ¾ inch, wt. 55 lbs.
- \* Equipped with ball bearing hold-down device.

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### GRAY TURRET HEAD METAL CUTTER OR NIBBLER

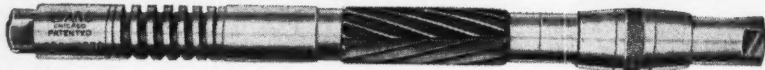
GRAY, Originator of First  
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Most modern Nibbler for Tem-  
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GRAY MACHINE CO.  
Box 596, Philadelphia, Pa.



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### LOOK AT THESE FEATURES

- No honing.
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- Full bearing surface.
- Left and right spirals.
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which is made of the training and experience of the sales engineer. The book offers in simple terms the principles of sales engineering; indicates the importance of the work, and suggests the opportunities in present-day society. Its answers to such questions as: "What is sales engineering?" "What possibilities does it offer?" "What must one do to be successful in this work?" and so on, are of immediate practical value in helping the sales engineer put his training to productive use.

Points of importance and special problems are illustrated throughout the book with a series of actual case studies. The experienced engineer will undoubtedly recognize among them problems very similar to ones which he has had to solve in actual practice. The young engineer will also find parallels to situations he meets.

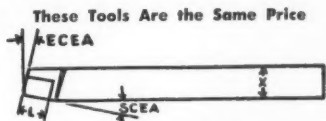
The author's extensive work in this field gives directness and clarity to the book. Mr. Lester has spent many years selling industrial machines and has trained and directed others to sell them. His analysis of the scope and problems of sales engineering can help the reader in appraising and improving his present sales methods, and broaden his usefulness by a better understanding of sales principles and practices.

**Gisholt Turret Lathe Tool Catalog.** The complete line of Gisholt Turret Lathe Tools for use on ram and saddle types of turret lathes is described and illustrated in a 168-page loose-leaf catalog published by the manufacturer. One hundred sixty four tools (many of them not previously announced), built in more than 500 sizes, are completely illustrated in three colors and short easy-to-read descriptions of each tool are given. Nearly 500 illustrations are employed to show pictures of each tool, its application, and its principal dimen-

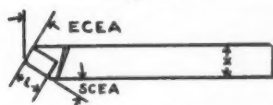


## HOW TO GET QUICKER DELIVERIES ON NON-STANDARD KENNAMETAL TOOLS

If a standard KENNAMETAL-tipped carbide steel cutting tool does not exactly fit your needs, you can often save money, and get quicker deliveries, by ordering a "Modified" Standard KENNAMETAL tool. Modifications may be made either in tool angles or in shank dimensions, with no increase in cost. One such modification is illustrated herewith.



Standard Style 11T80 KENNAMETAL tool with 15° SCEA, 15° ECEA, and 7" long shank



Modified Style 11T80 KENNAMETAL tool with 30° SCEA, 38° ECEA, and 5 1/2" long shank

Send today for our new Catalog No. 41 listing standard styles and prices for KENNAMETAL tools. Also ask for leaflet showing how to order Modified tools.



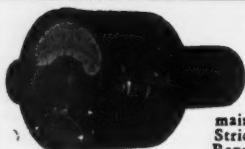
sions. Dimension drawings are large enough to permit direct scaling to layout sheets, and the individual file-size ( $8\frac{1}{2}$  x 11-in.) pages may be removed from the catalog for reference without tearing out.

Such unique features as completely-pictured suggested standard sets of tools for a specific size of machine and type of work, a cross-reference 10-page index for all tools, and a separate section devoted to attachments which may be added to present turret lathes, make

the catalog particularly valuable to turret lathe users.

Copies of the catalog will be supplied only to those who write direct to the Gisholt Machine Co., 1219 E. Washington Ave., Madison, Wis. Turret lathe

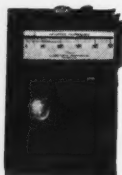
## PYRO RADIATION PYROMETER



**STOP** spoilage. Get exact temperature of work in furnace. Direct reading; no calculations; no maintenance expense. Strictly automatic. Range 1000-3600° F.

Write for Illustrated Bulletin 100.

**THE PYROMETER INSTRUMENT CO.**  
101-105 Lafayette St. • New York



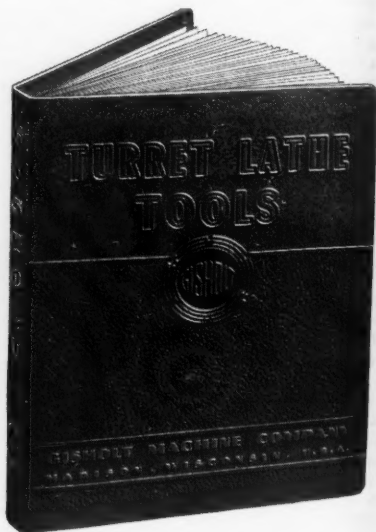
## "Alnor" Electronic Controller

A simplified type of temperature controller.

No Motors—No Depressor Bars  
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Illinois  
Testing Laboratories, Inc.  
153 W. Hubbard St., Chicago



users can obtain the catalog at no cost by writing on their company letterhead, listing the make and model of machine used and the writer's title or occupation. All others, including students and teachers, can obtain a copy by accompanying their request with a remittance of \$2.50 to defray cost of printing and mailing. Although no credit will be extended, a 10-day inspection trial will be granted.

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## Bronze Metal"

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**Mechanical Vibrations.** By J. P. Den Hartog, Associate Professor of Applied Mechanics, Harvard University. Second Edition. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. 448 pages. Cloth binding, board covers.

Mechanical and electrical engineers dealing with vibration phenomena will find this book a thorough treatise emphasizing the many important applications of principles and calculations. The book gives complete explanations and proofs, yet employs no mathematics higher than simple differentiations and integrations. The results of all important calculations are given in graph form for convenience of reference.

New material not available in the first edition includes electrical measuring instruments, centrifugal pendulum dampers, aircraft and ship propellers, and automatic balancing machines. An appendix lists in a comprehensive manner the formulas that are likely to occur in practice.

Other important topics which receive a thorough treatment are: the theory of vibration isolation and its application to single-phase electrical machinery and to automobiles; ship stabilization; automobile shock absorbers; propeller vibration in airplanes; flutter of airplane wings; vibration of steam turbine

transmission lines; torsional vibration wheels and blades; galloping of electric dampers; the principles of superposition; hunting of steam engine governors, and so on.

**Porter-Cable Universal Milling Machine Attachments** for hand and power feed millers are illustrated and described in Bulletin 206A-CM-SCH-CPO released by the Porter-Cable Machine Co., 300-1 Wolf St., Syracuse, N. Y. Copy free upon request.



## ROTARY MAGNETIC CHUCK

Permanent Magnet Type

**— No Electric Current**

required . . . . . Permanent magnets  
 have strong holding power — last indefinitely  
 . . . . . Unusual convenience and economy —  
 No wires — No heating — No running costs

**— Ask for circular on Rotary and Rectangular Models**

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**Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.**

# BROWN & SHARPE



# FOR YOUR CATALOG LIBRARY

*To obtain copies of the catalogs listed here,  
indicate on the coupon the number of the item  
in which you are interested and mail as directed.*

**1. Burs and Cutters**

New catalog DSB-27, issued by Grobet File Corp. of America, 3 Park Place, New York, N. Y., shows the complete line of small Grobet Burs or Cutters with  $\frac{1}{8}$ " and  $\frac{3}{32}$ " shanks.

**2. Honing Machine**

New folder released by Enterprise Machine Parts Corp., 2731 Jerome St., Detroit, Mich., illustrates and describes the EMPCO Honing Machine.

**3. Wrenches**

Blackhawk Mfg. Co., Milwaukee, Wis., has issued new Catalog No. 241, illustrating and describing Blackhawk wrenches of socket, open-end and box types, complete assortments in modern cases and portable wrench benches.

**4. Watchman's Clock**

Detex Watchclock Corporation, 76 Varick St., New York, N. Y., has issued a folder detailing the Detex Alert precision built watchman's clock.

**5. Kennametal Tools and Blanks**

New Catalog No. 41, featuring Kennametal steel and metal cutting tools and blanks, has just been released by McKenna Metals Co., Latrobe, Pa.

**6. Collapsible Taps**

New Bulletin M-111, illustrating and describing Modern Collapsible Taps, Stationary and Rotary, is available from Modern Tool Works, Rochester, N. Y.

**7. Collet Chuck**

New folder detailing the Erickson Precision Collet Chuck has been issued by Erickson Steel Co., 80th and Bessemer Ave., Cleveland, Ohio.

**8. Abrasives for Portable Grinders**

An interesting 28 - page booklet titled "Grinding and Finishing With Portable Equipment" is available from Norton Co., Worcester, Mass.

**9. Munitions Threading**

Landis Machine Co., Waynesboro, Pa., has available new bulletin titled "Precision in Munitions Threading."

**10. Tangent Dies With Ground Thread Chasers**

Booklet No. 97, issued by Jones & Lamson Machine Co., Springfield, Vt., details information on J. & L. Tangent Dies With Ground Thread Chasers.

**11. Gear Cutting**

"The Practical Art of Generating" is the title of a book relating to gear generating now available from The Fellows Gear Shaper Co., Springfield, Vt.

**12. Hand Miller**

W. H. Nichols & Sons, Waltham, Mass., has available catalog illustrating and describing the Nichols Hand Miller.

**13. Portable Electric Drills**

Thor Catalog No. 37, illustrating and describing  $\frac{1}{4}$ " drills and other electric tools, may be had from Independent Pneumatic Tool Co., 604 W. Jackson Blvd., Chicago, Ill.

#### 14. Pneumatic Die Cushion

New folder just released by Dayton Rogers Mfg. Co., 2830 13th Ave., South, Minneapolis, Minn., illustrates and describes the new improved Dayton Rogers Universal Pneumatic Die Cushion.

#### 15. Drilling Angular Holes

A new 28-page booklet titled "How to Drill Square, Hexagon, Octagon, Pentagon and Triangular Holes" has been issued by Watts Bros. Tool Works, Wilmerding, Pa.

#### 16. Non-Tempering Tool Steel

Bulletin featuring Atlantic '33' non-tempering tool steel has been issued by Atlantic Steel Company, 1775 Broadway, New York, N. Y.

#### 17. Horizontal Boring Mill

The Yoder Company, 5500 Walworth Ave., Cleveland, Ohio, has released bulletin featuring Yoder Horizontal Boring Mills.

#### 18. Milling Fixtures and Dividing Heads

Hart Machine Co., 24 Mather St., Dorchester, Boston, Mass., has available bulletins detailing Hart Milling Fixtures and Dividing Heads.

#### 19. Self-Locking Drive Pins

Circular featuring Driv-Lok Self-Locking Drive Pins is available from The Driv-Lok Co., Inc., 1525 Railroad Ave., Bridgeport, Conn.

#### 20. Clutches

Details on Pullmore Clutches are presented in Pullmore Blue Book showing installations. Rockford Drilling Machine Co., 300 Catherine St., Rockford, Ill.

#### 21. Motor Drive

Bulletin featuring the Lima Gear-shift motor drive may be had from The Lima Electric Motor Co., 440 N. Main St., Lima, Ohio.

#### 22. Die Sets and Accessories

The Producto Machine Co, Bridgeport, Conn., has issued a new 96-page catalog featuring die sets and accessories for tool and die makers and users of power presses.

#### 23. Surface Pyrometers

The Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y., has available Catalog No. 120, featuring Pyro Surface Pyrometers.

#### 24. Key Seating Millers

National Machine Tool Co., 2270 Spring Grove Ave., Cincinnati, Ohio, has issued Catalog No. 15, illustrating and describing National key-seating millers.

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Emeco Honing Machine is the subject of an illustrated and descriptive four-page folder now being distributed by the Enterprise Machine Parts Corp., 2737 Jerome Ave., Detroit, Mich. Copy free upon request.

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## Did You Know That—

—every manufacturing plant in the United States, no matter how small, may take part in National Defense work? See page 122.

—the finish on metal parts can be controlled by controlling the manner in which the chips weld to the cutting edge of the tool, and that this can be done through the cutting oil? See page 90.

—a rubber punch is used in the blanking and forming of parts for airplane construction? See page 181.

—machine tools are now made with dial indicators which show the depth of the cutting tool or drill in the work, within 0.00025 inch? See page 79.

—the huge guns used in coast defense work and on battleships, some of which are bored to 20-inch caliber and 87 feet long, are machined within a total tolerance of 0.002 inch? See page 110.

—one firm is now marketing 596 separate tools for use on turret lathes? See page 87.

—a rivet can be made to "head" itself in a tight place? See page 160.

—a die head to cut a 3/16-inch thread, 100 threads per inch, is now available? See page 120.

—the modern Diesel engine converts from 35 to 40 per cent of fuel to energy? See page 74.

—molten babbitt can be poured from the bottom of a ladle, thus avoiding the dirt or dross which may be floating on the top? See page 244.

—any shop can, at small expense for equipment, make and braze its own Carbonyl tools? See page 70.

—polishing wheels are now made with binder of soft rubber? See page 126.

—after a huge defense gun has been bored and turned, it is expanded by hydraulic pressure? See page 114.

—modern die steels make it possible to blank as many as 250,000 pieces from 0.062-inch stock between die grinds? See page 129.



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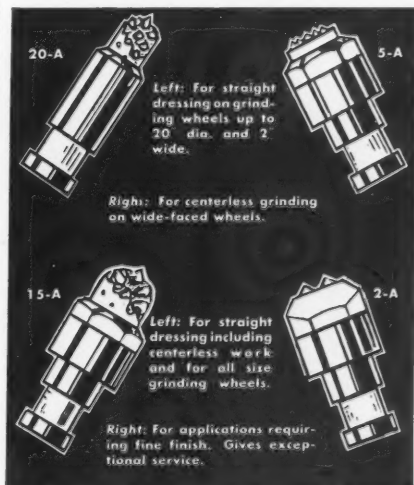
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Detroit, Mich.    Cleveland, Ohio





New Factory of Star Electric Motor Company and Star Machine & Engineering Company

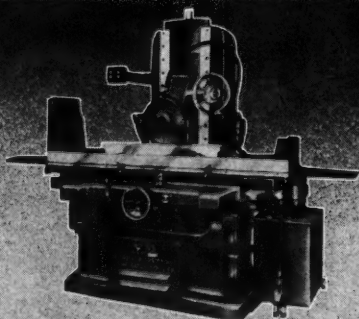
### New Factory Building for Star Companies

The illustration shows the new factory building recently acquired by the Star Electric Motor Company, the Star Equipment Corporation, and the Star Machine and Engineering Company, all of Bloomfield, N. J. The building contains 165,000 sq. ft. of floor space, all of which is on one floor except for the second floor of the offices. The site contains eight and one-half acres.

The Star Electric Motor Company manufactures electric motors, generators, geared-head motors, magnetic brakes, and similar power apparatus. The Star Machine and Engineering Company, started in 1935, manufactures precision drill grinding equipment.

**Hevi Duty Box Type Electric Furnaces.** Complete information on Hevi Duty Box Type Electric Furnaces which can be applied to practically all types of

heat-treating processes is contained in a four-page bulletin released by the Hevi Duty Electric Co., Milwaukee, Wis. Copy of Bulletin HD 441 free upon request.



● This "GRAND RAPIDS" Hydraulic Feed Surface Grinder was designed for you—to earn greater grinding profits in your plant. Table speeds up to 150 ft. p.m. with minimum power and wheel cost. Sizes from 6" x 18" to 30" x 144".

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